



Blue House In Sisimiut, Greenland

Initial investigation of the Blue House

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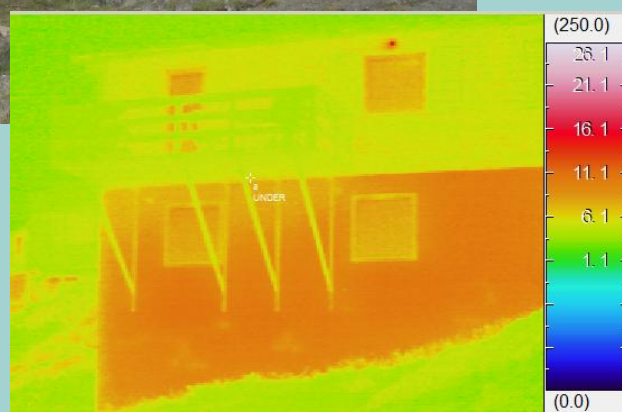
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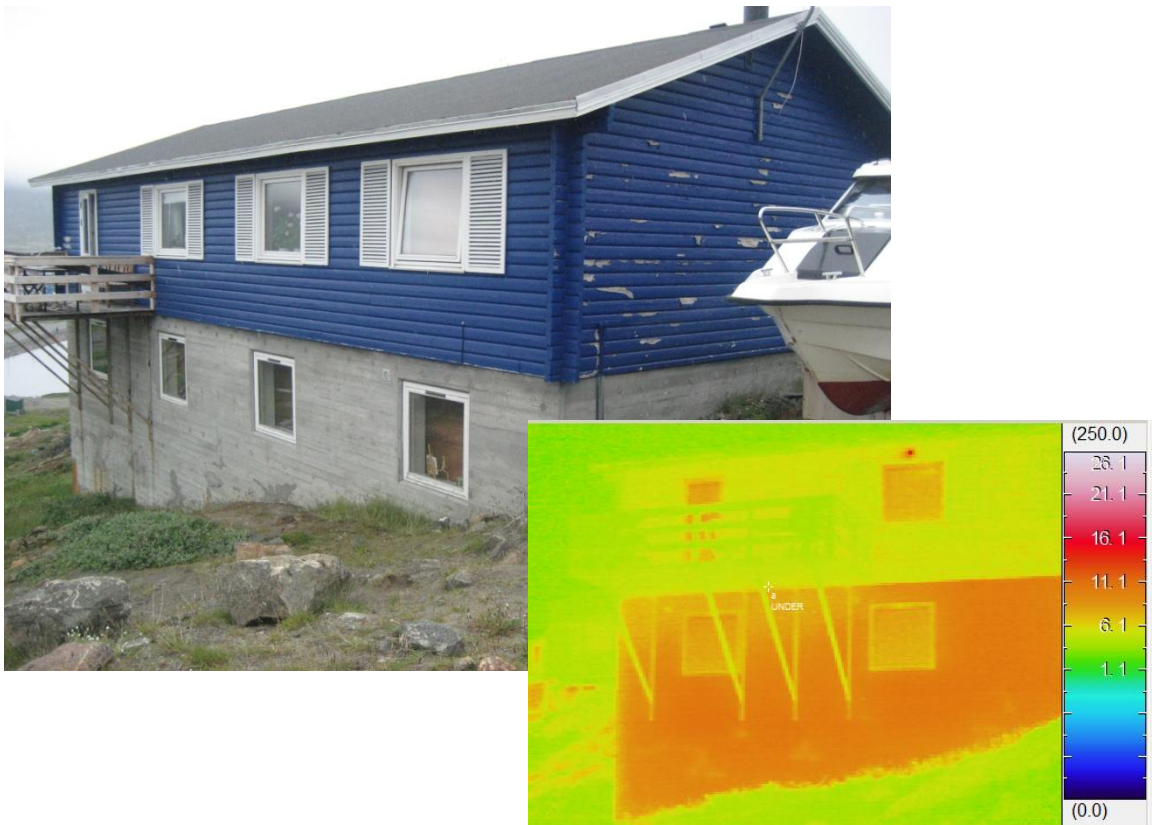
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BLUE HOUSE IN SISIMIUT, GREENLAND

Initial investigation of the Blue House



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Report SR 10-07

August, 2011

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Technical University of Denmark**

Preface

The Blue House is part of the NEES project (Natural Energy Efficiency and Sustainability) as part of the Northern Periphery Programme. The task of the NEES project is to identify and promote products and services which aim to improve energy efficiency in existing domestic buildings, which make use primarily of renewable and/or recycled materials and services based on natural processes, which originate and are normally accessible in the Arctic regions. The project also focuses on the survey of practises, dissemination of knowledge through learning in Greenland and other Arctic regions.

The Blue House is one of the examples where the paper insulation will be installed. The results of energy savings and safe implementation of paper insulation will be documented. This report will serve as documentation regarding the house and its initial state. This report summarizes the survey of the Blue House in Sisimiut, Greenland. The survey was performed in August, 2011. The initial state of the Blue House with possible problems is reported in the report. Furthermore, possible issues and solutions for paper insulation are proposed.

The person responsible for evaluation of results and writing this report is Petra Vladykova. Jing Qu was advising and correcting the report.

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1 Information about the Blue House

Name: Blue House, blå hus, Axel´s house

Type: Panbo Typehus 1

Address: Qajasat 19, B-1158, 3911 Sisimiut, Greenland



Fig. 1. The Blue House

The house has been built in 1985 as one of the typehouse produced by Panbo Huse A/S, Denmark (Panbo Huse, 2011) and it is made from a special construction from timber structure. There are only few of these typehouses located in Sisimiut. Former owner and purchaser of the house was Hans Martin Johansen, doctor. Today, the house is owned by the Municipality of Qeqqata and administrated by INI A/S (Fig. 1).

For the past 4, the house is rented to Axel Lund Olsen and his family for 4.513,- DKK/month not including the utility and other bills. Currently there are 3 people living in the house (two adults, one child). The house is built on the top of the small hill above the lake in the middle of city of Sisimiut (Fig. 2).



Fig. 2. Location of the house in Sisimiut

2 Methods of investigations in the Blue House

The investigation includes the review of the history of the house regarding the original design of the house, ownership and occupancy. Furthermore, the investigation and measurements of the house was the base for creation of new documentation. At the time of investigation, there were available only drawings for one-storey PANBO house, and, thus, the Blue house had to be measured again to make sure that there were no changes. And the measurements and documentation of basement floor together with first floor were obtained (AutoCAD). The original drawings, further documentation and drawing documenting current state of the house are attached in Annex A, B and C.

The information about the building's structure was taken to register building elements such as walls, floor, roof, windows and doors. Furthermore, the technical systems in the house were registered. The investigation of the Blue House includes the visual investigation, inspection for mould, inspection of basement, and occupancy in the house along with data collection from inhabitants. Furthermore, the collected data about the house and from measurements are evaluated based on the interview with inhabitants and questionnaire, the usage and problems with the house were registered.

Furthermore, the indoor climate measurements are providing data for temperature and relative humidity for the period from Dec 2010 until Aug 2011. These data are evaluated and the use of the house and possible problems with the sensors are listed. The measurements in the house also include the blower-door and thermography testing. The results of the air tightness of the building envelope from the blower-door tests along with infiltration heat loss are evaluated and compared to several Standards and actual buildings in Sisimiut, Greenland. Thermography investigation shows some problems with the coldness of the house and thermal bridges in the structure. Furthermore, based on the collected bills for heating and hot water consumption, the actual energy consumption in the house is investigated. Approximation of monthly energy consumption is represented together with estimation of hot water consumption. These data are compared to the requirements from the Building Regulations.

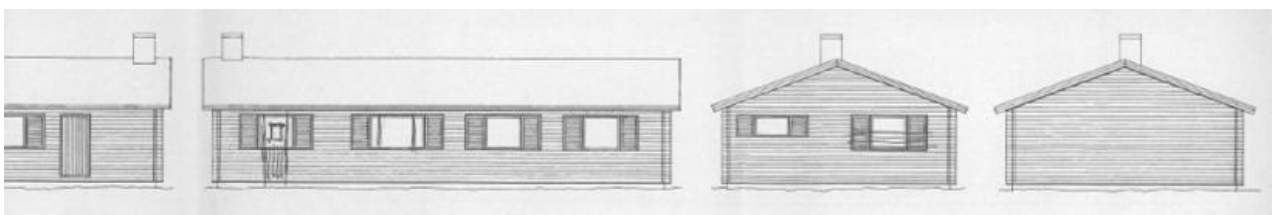
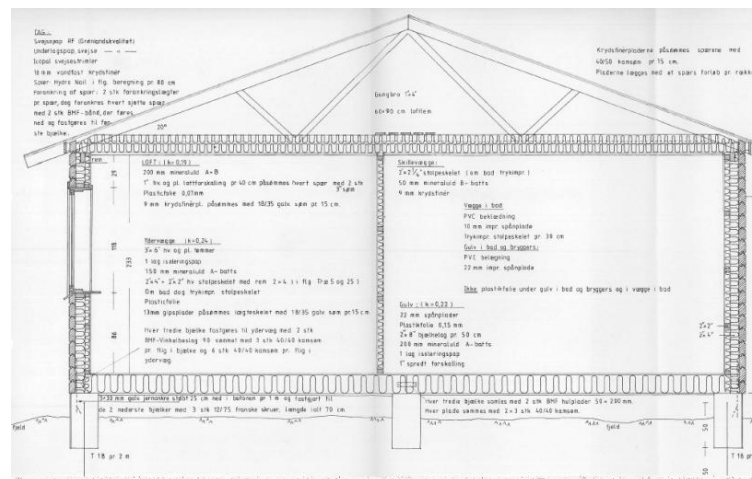
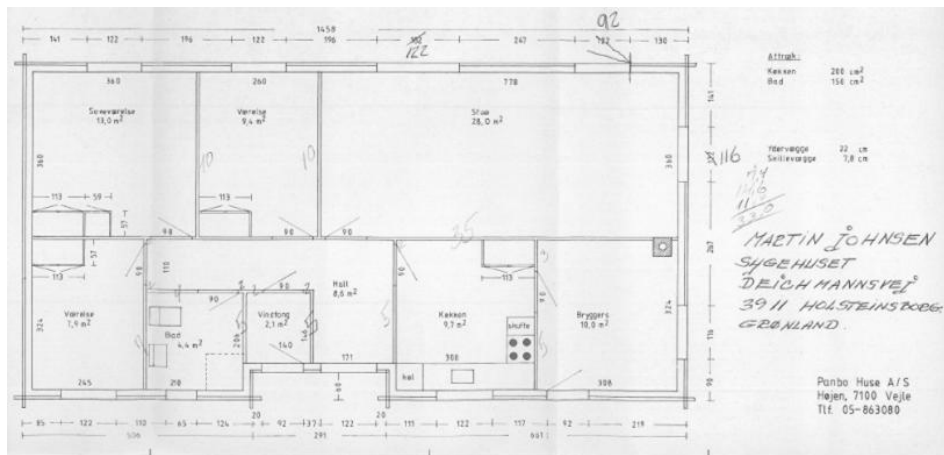
Each chapter contains theoretical explanations of necessary background information; if necessary the equations and reference sources are listed. Furthermore, each chapter contains a presentation of results, processing of the obtained results and conclusion regarding the analyses.

The final chapter describes some issues connected to the paper insulation installation along with possible problems, further evaluations and future monitoring.

3 Results from investigations and measurements

3.1 History of the house

Originally, the house has been designed as a one-storey house where the following rooms were located: entrance, hall, bathroom, 3 bedrooms, living room, and kitchen along with technical/utility room (Fig. 3, Fig. 4 and Fig. 5). Originally, the house has been designed as a building with open ventilated basement (crawl space underneath the house) with the foundation made of concrete and the open ventilated attic (see Annex A and B). Originally, the gross heated area of the house was 109 m².



In the current state, the house has a first floor and a heated basement floor which extends underneath the whole first floor. The first floor has an entrance with hall connecting bathroom, office, large bedroom, and living room connected with dining room and kitchen (Fig. 6). There is a staircase to the basement floor which has two bedrooms, technical room with boiler (not intentionally heated), storage room, utility room, office, cold entrance (not heated) and bathroom (Fig. 7). The two storey of the house are thermally connected and are considered as one thermal zone (Fig. 8). The house has one catwalk leading to the main entrance to the house and a balcony orientated towards west (Fig. 9 and Fig. 10). For more details see Annex C.

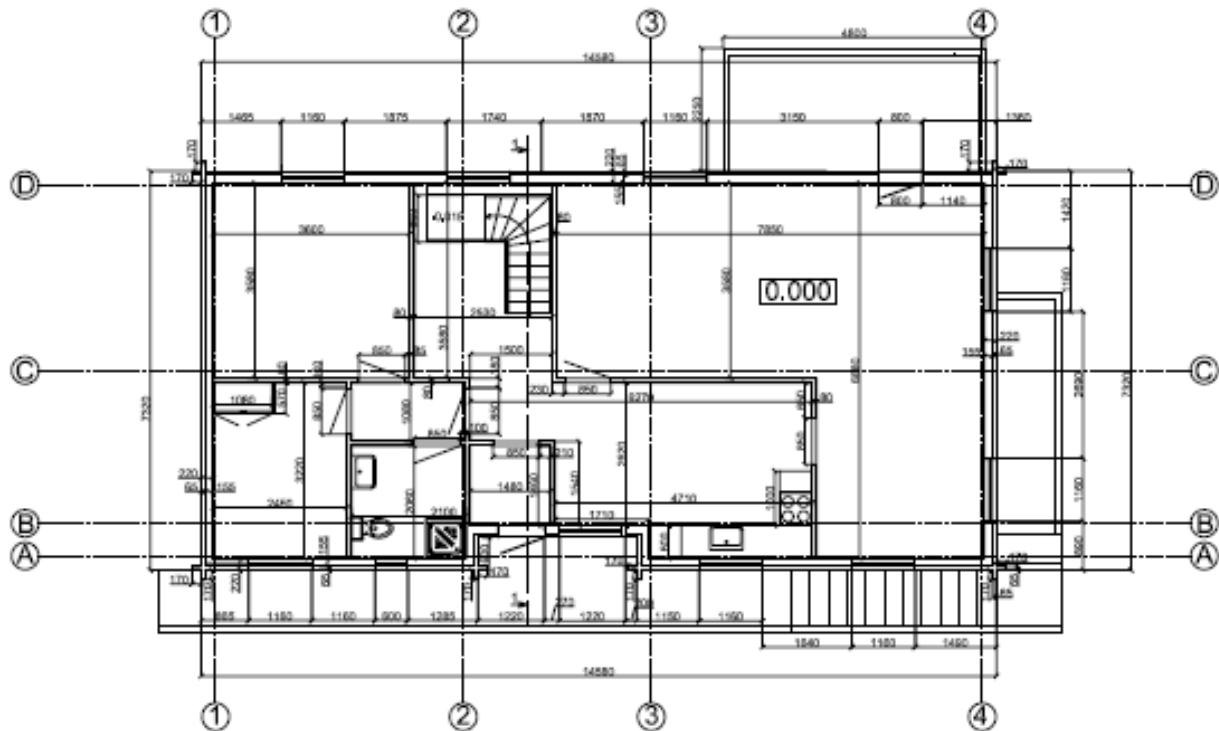


Fig. 6. Floor plan of the first floor – current situation

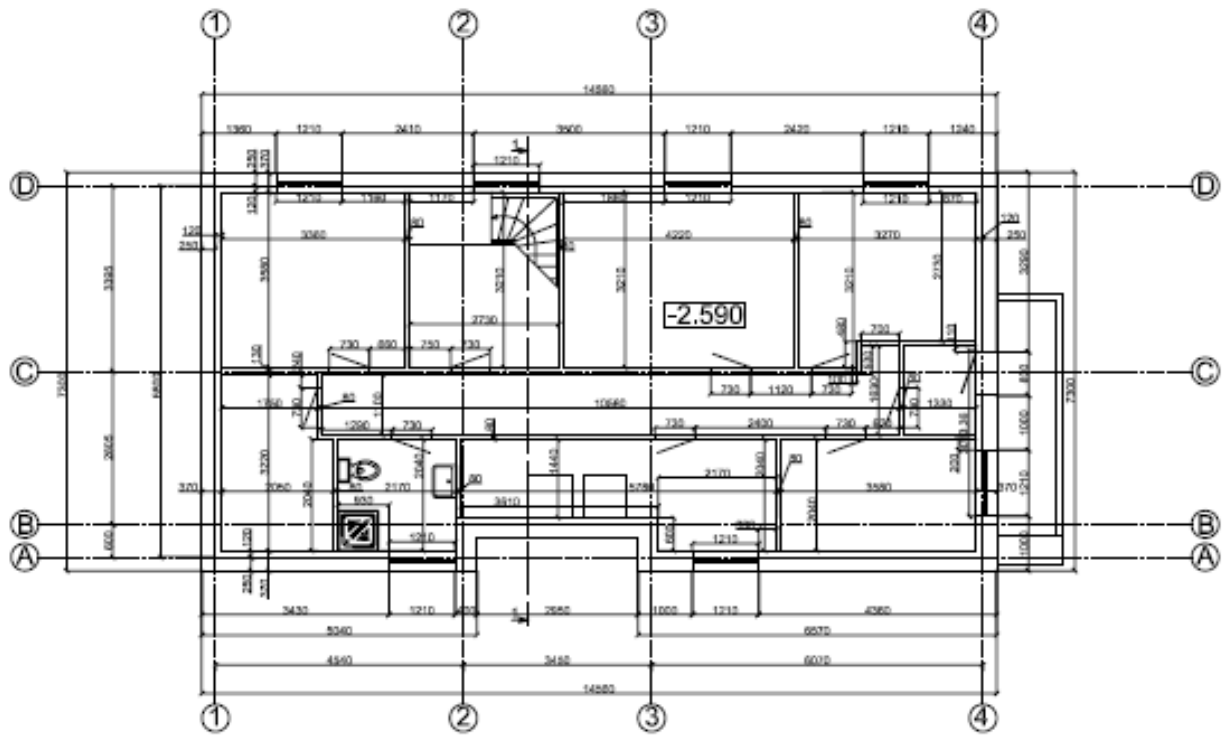


Fig. 7. Floor plan of the basement floor – current situation

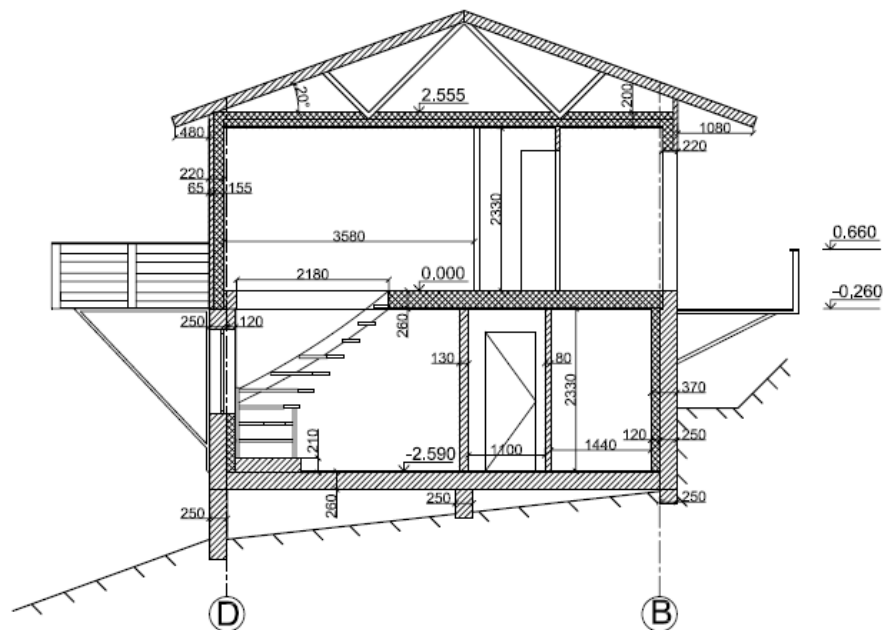


Fig. 8. Cross section of the house – current situation



Fig. 9. South and north view of the Blue House



Fig. 10. East and west view of the Blue House

The key data of the house are listed in Table 1.

Table 1. Buildings' basic parameters (current state)

Information		Area	Unit
Dimensions of the footprint area		14.58 x 6.84	[m]
Clear height of the room		2.33	[m]
Gross heated area ⁽¹⁾	A_{gross}	209	[m ²]
Envelope surface area	A_{envelope}	379.7	[m ²]
Net volume area of a building	V_{net}	452.4	[m ³]

⁽¹⁾ Not including the cold entrance in the basement floor.

3.3 Building's structure

The first floor of the house is made of a special timber structure with mineral wool insulation and the basement floor is made of concrete with insulation placed on interior side. It is assumed that the house is built as a Panbo house in the first floor with the original structure of walls, ceiling, floor, and roof. The basement floor is an additional structure further described below. The actual foundations of the house are made from reinforced concrete bands on rock bed, and there is an assumption that the foundations are filled with soil and the wooden casting cladding has been left in. The sloped roof has inclination of 20° made of self-carrying roof structure and the roof is oriented towards west and east. The height of the ceiling in the first floor and basement is identical, i.e. 2.33 m of clear height (Fig. 8). The construction and layers of each building element are described further and the important technical values are listed in Table 2.

The external walls of the first floor consist of painted timber members with dimensions of 75 x 150 mm (3"x 6") as external weather proof cladding, 1 layer of insulation paper, 150 mm of mineral wool insulation (batts), combined structure of wooden members 50 x 50 mm (2" x 2") with 50 mm of mineral wool insulation, plastic foil working as a vapour airtight membrane and on the inside is one layer of gypsum board of 13 mm (Fig. 11). The external walls of basement floor are made of concrete of 250 mm, 80 mm of insulation, air gap and vertical board of 12 mm and 13 mm of gypsum board on the interior. The total thickness of the basement walls is 370 mm (Fig. 12).

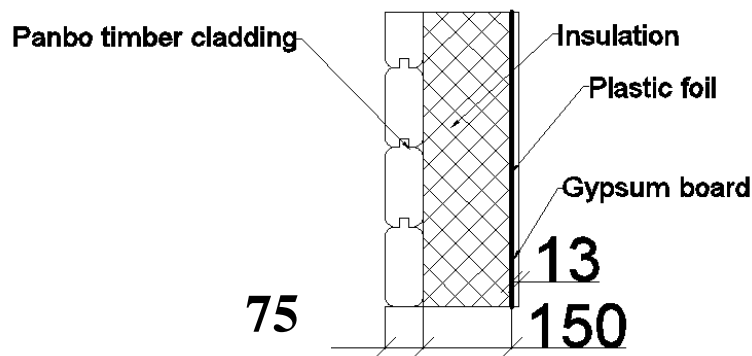


Fig. 11. Construction of original wall (first floor)

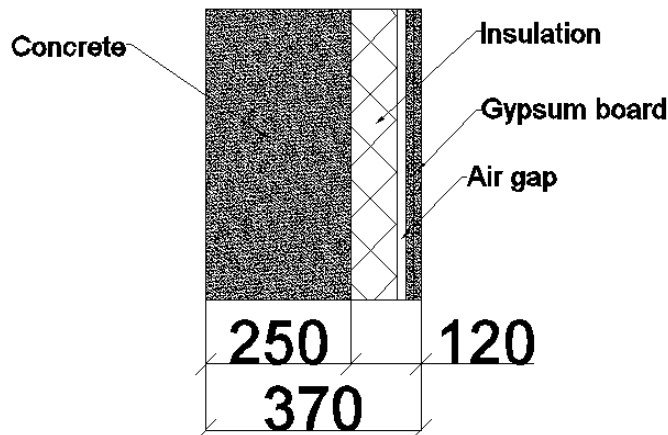


Fig. 12. Construction of basement wall (basement floor)

The external roof is made of asphalt water tight layers (bitumen), 16 mm of water tight plywood, and the wood load bearing structure for the roof. The internal ceiling above 1st floor to the attic consists of 200 mm of mineral wool insulation laid freely on the ceiling toward the exterior and wooden members 50 x 200 mm (2"x 8"), and 9 mm gypsum board on the interior side. The external floor towards the cold crawl space below the house is assumed to be made of flooring structure (carpet or wooden floor), plastic foil 0.15 mm, timber structure 50 x 200 mm (2" x 8") and 200 mm of insulation (A-batts), layer of insulation paper and boards.

The internal walls are made of gypsum board on both sides and insulation with timber wooden structure in middle. The internal non load bearing walls have thickness of 80 mm. Approximately in the middle of the house along the long side of the house runs the internal load bearing wall throughout the basement and first floor (Fig. 8). Thickness of load bearing internal wall is 100 mm.

The internal ceiling above the basement floor to the first floor is 260 mm thick and it is made wooden girders of 50 x 200 mm (2"x 8") and 200 mm of insulation, and gypsum boards at bottom side and wooden flooring of 22 mm on the top side (Table 2).

Table 2. Calculated / estimated U-values for buildings elements

Building element	Insulation thickness [mm]	U-value [W/(m²·K)]
External wall – first floor	150 + 50	0.24 ⁽¹⁾
External wall - basement	80	0.38 ⁽³⁾
Floor	200	0.22 ⁽¹⁾
Ceiling	200	0.19 ⁽¹⁾
Door	-	2.0 ⁽²⁾
Window	-	1.8 - 2.0 ⁽²⁾

⁽¹⁾ Obtained from original drawings. ⁽²⁾ Estimated values based on GBR 1982 and 2006. ⁽³⁾ Calculated in accordance with (EN ISO 6946, 2005).

The external doors are wooden insulated door but there is no further technical description, there are total of 3 external doors to a terrace and balconies (Table 3). The internal doors are classic wooden door (dimensions: 850 x 2,000 in the first floor; 730 x 2,000 in the basement floor). The internal doors to the technical room are partly tight with rubber sealer. There is a hatch to the cold attic.

Table 3. Windows types and door dimensions

Windows / doors	Dimensions of opening [m]
V1	1.160 x 0.650
V2	1.220 x 1.220
V3	0.650 x 1.220
D1	0.920 x 2.000

The windows have a frame from wood and double glazing. Windows in the basement have been installed when the house was built (85/11, PANALOOK 160~DS~10940 TF GAR). The windows in the first floor have been changed approximately 14 years ago (12/97, 190~DS~10940~1AT-class). All windows are a type

of awning window with top-hung or side-hung (Fig. 13). Most of the windows have a natural exhaust vent placed next to them. There are three main types of the windows which are listed in Table 3.



Fig. 13. Windows used in the Blue House

Static problems were discovered at the time when few of Panbo houses were built in 1980s and the supplementary static calculation due to the strong wind and pressure was provided by a local building company. Based on this static calculation, the house was further more strengthened and restructurized, i.e. additional new fittings and plywood panels. This information was obtained based on the discussion with Jørn Hansen from Rambøll during the NEES meeting on 13.8.2011.

3.4 Technical systems in the building

The space heating is provided with a oil-boiler (type HS Hedler TARM) with an expansion vessel and a hot water storage tank. The conventional hydronic heating system is located in the house with 8 radiators with thermostatic valves in the first floor and 6 radiators with thermostatic valves in the basement floor. The oil-boiler also supplies hot water. The tank for the oil is located in the technical room in the basement floor (Fig. 14).



Fig. 14. Oil tank and oil-boiler in the technical room

The fresh air is provided through the natural ventilation with vents (6 opening vents in the first floor with diameter 120 mm and 5 opening vents in the basement floor with diameter 200 mm) and they are placed in each room close to the top of the window (Fig. 15). There is a mechanical exhaust in kitchen (kitchen exhaust hood) and in bathrooms (electrical exhaust vents along with natural ventilation vent). The mechanical exhaust vents in the bathrooms are based on a “switch on / off” together with light, meaning that there is no delay after switching the light off and, thus, the release of humidity. The cold attic is ventilated through the natural vents through facade (Fig. 16).



Fig. 15. Natural vents in the first and basement floor



Fig. 16. Mechanical vent in the bathroom and natural ventilation in cold attic

There are many domestic electrical appliances in the house such as: coffee maker, kettle, various small kitchen appliances, microwave, CD/DVD/radio players, TV's, freezer, fridge, oven, wash machine and dryer. The lighting is provided with energy saving light bulbs.

The water is supplied to the house from the city water supply. The black and grey water is lead from the house to the district sewage system.

3.5 Problems in the house

This information is based on the investigation and discussion with current inhabitants. Some information was also supplied from the questionnaire provided by Martin Kotol for the Ph.D. project: “Energy use and indoor environment in new and existing dwellings in arctic climates“, see Annex D.

- Inclined and squeaky floor in the 1st floor.
- The frames of the windows and doors are affected and they are not at 90° angle. There exists a suspicion of static problems with the house (foundation problems or settling of the house).
- There were found cracks in the basement walls and some traces of leaking water from beneath the house from the crawl space (Fig. 17).
- Problems with a squeaking sound from the building's structure when there is a big windstorm.
- The exterior facade is stripping off and needs repainting. The stripping off is possibly caused by demanding weather conditions and possibly by a vapour transfer driven from interior to the exterior (Fig. 17).
- The mechanical ventilation in the bathrooms only is switched on when the lights are on, there is a need for a delayed mechanism after the light is switched off.
- The doors on the north side to the basement are not tight and there has been observed 40 mm of frost at the bottom in the winter by occupants.
- Mould problems in the house were registered by the occupants and it has been repaired by INI, but further documentation is missing.
- Floor in the bathroom in the basement often gets flooded.
- The inhabitants often complained about the cold floors, especially in the basement floor.
- There are also some problems with temperature in the house, i.e. overheating in summer and cold in winter, and uneven distribution of the temperature in the both floors.
- Occasionally, there is also a condensation on the windows in winter.



Fig. 17. Cracks in the basement walls (on the left) with water leakages through the foundations and the exterior painting

3.6 Indoor climate

3.6.1 TinyTags sensors and locations

The indoor climate is measured continuously from December 7, 2010, onward (first readout from April 5, 2011; second readout from August 8, 2011). The Tiny Tags loggers were used to measure interior temperature and relative humidity. The logging time is every 20 minutes. For downloading the data the software Tinytag Explorer is used (6-week demo version, <http://www.geminidataloggers.com>). The locations of the sensors are as follows (Fig. 18, Fig. 19): bathroom (basement floor), bedroom (first floor), children's bedroom (basement floor), and living room (first floor) and exterior temperature (Fig. 20, Fig. 21).



Fig. 18. Location of Tiny Tags in living room (1) and bedroom (2) (first floor) and outside (3)



Fig. 19. Location of Tiny Tags in bathroom (4) and child's bedroom (5) (basement floor)

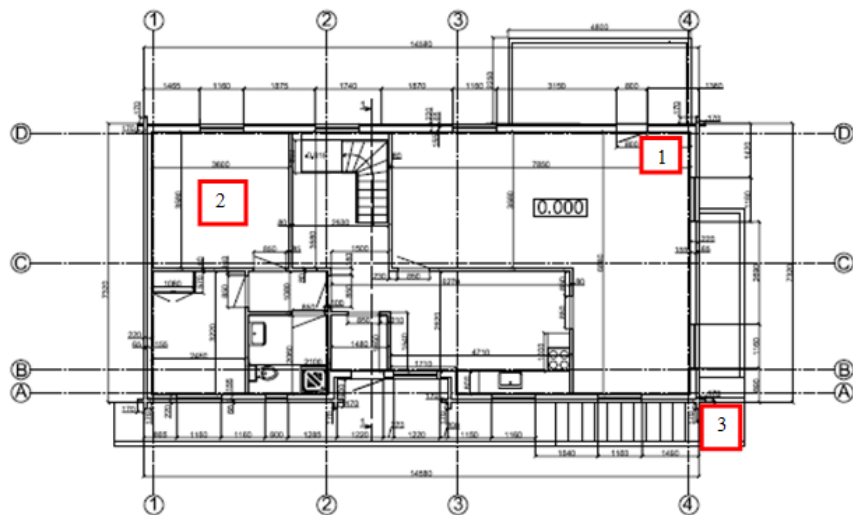


Fig. 20. Location of sensors - first floor

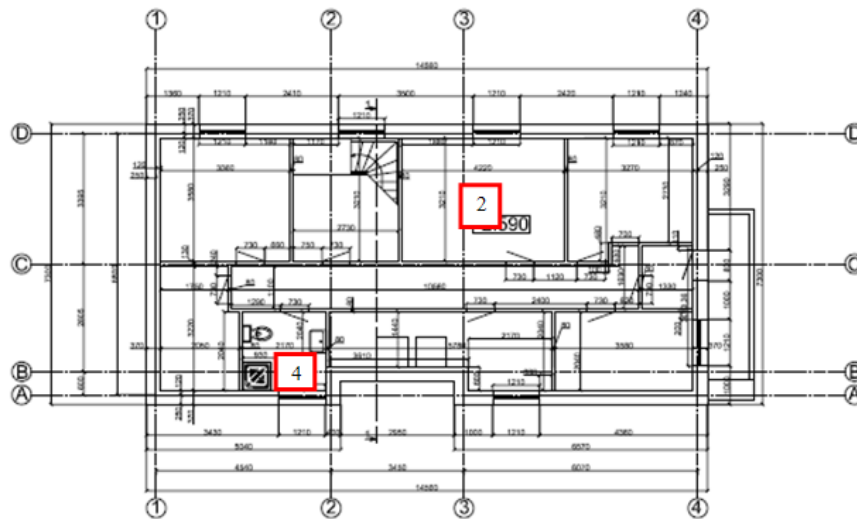


Fig. 21. Locations of sensors – ground floor

3.6.2 Measured data of temperature and relative humidity

Table 4. Average measured temperature and relative humidity from Dec 12, 2010, to Aug 8, 2011

Space	Average temperature	Average relative humidity
	[°C]	[%]
Outdoor	-2.2	72.7
Bathroom (basement floor)	19.6	35.9
Bedroom (basement floor)	14.3	42.4
Bedroom (first floor)	20.7	32.2
Living room (first floor)	18.6	38.4

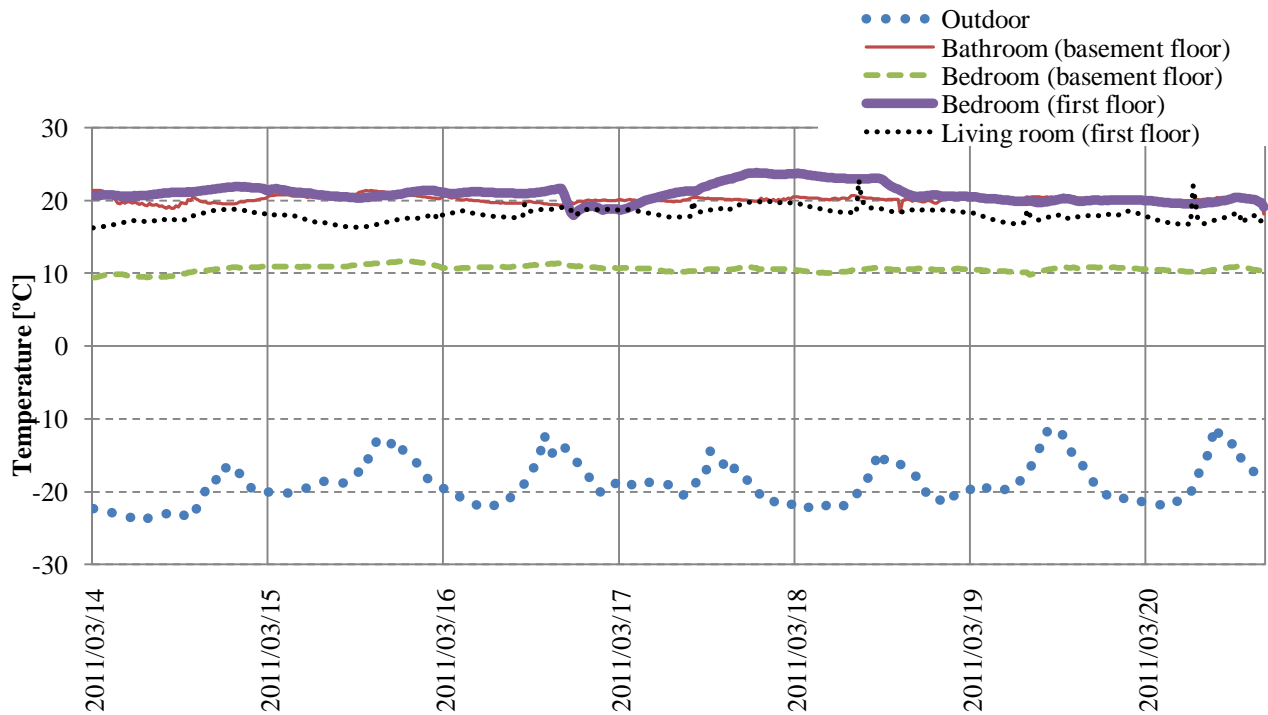


Fig. 22. Measured temperature in the coldest week of 2011 (based on a coldest hourly temperature measured outdoor, -23.8°C)

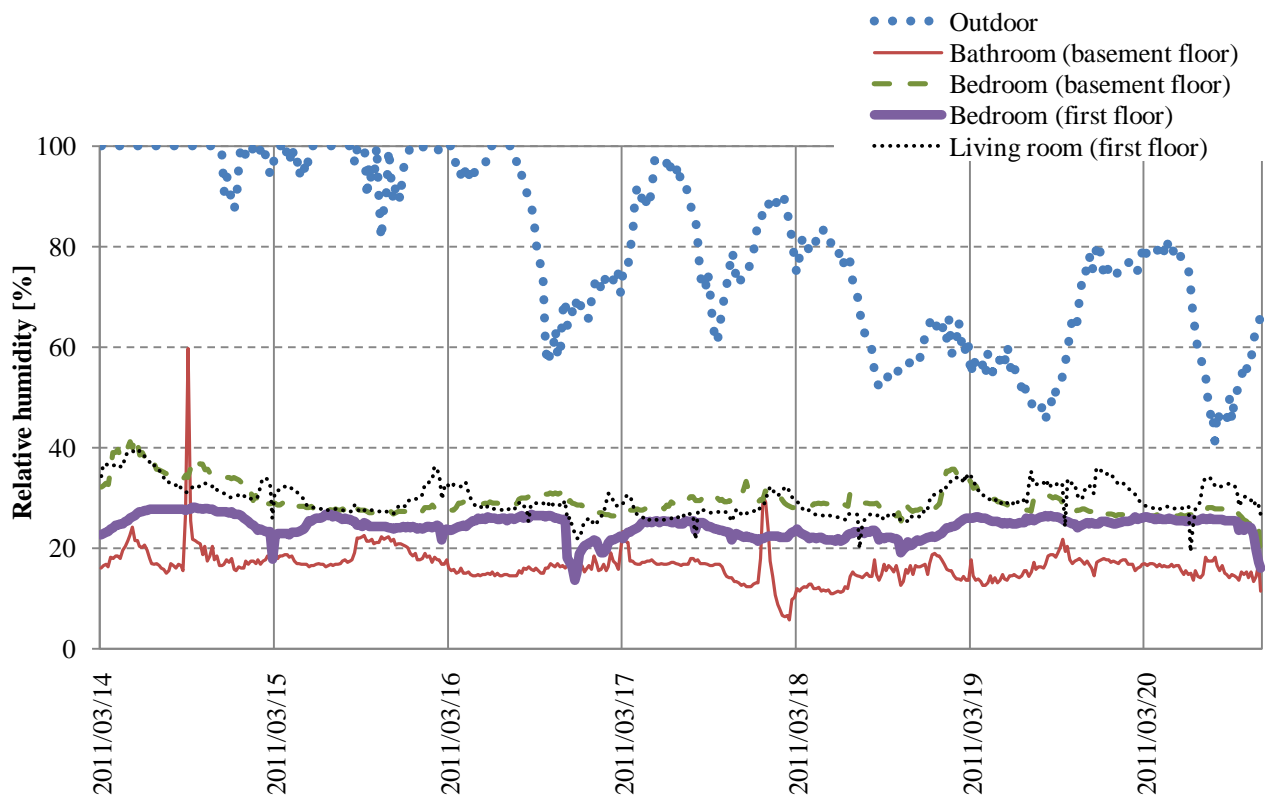


Fig. 23. Measured relative humidity in the coldest week of 2011 (based on a coldest hourly temperature measured outdoor, -23.8°C)

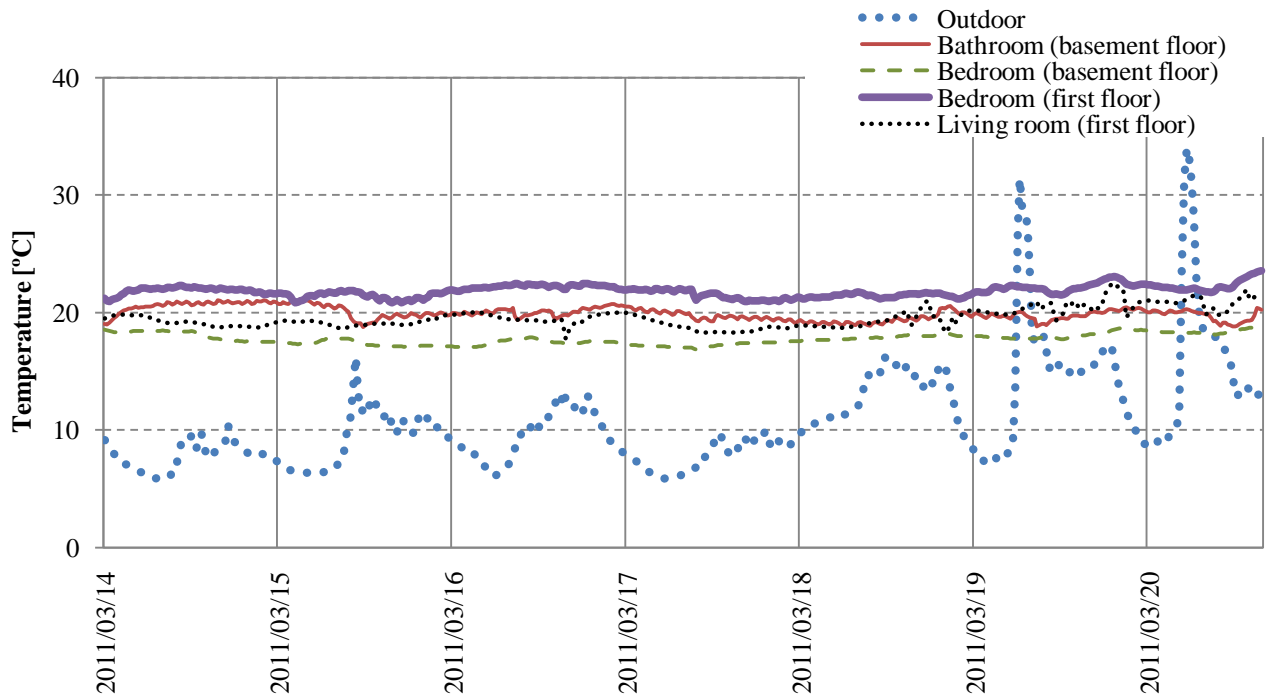


Fig. 24. Measured temperature in the warmest week of 2011 (based on a warmest hourly temperature measured outdoor, 33.9°C)

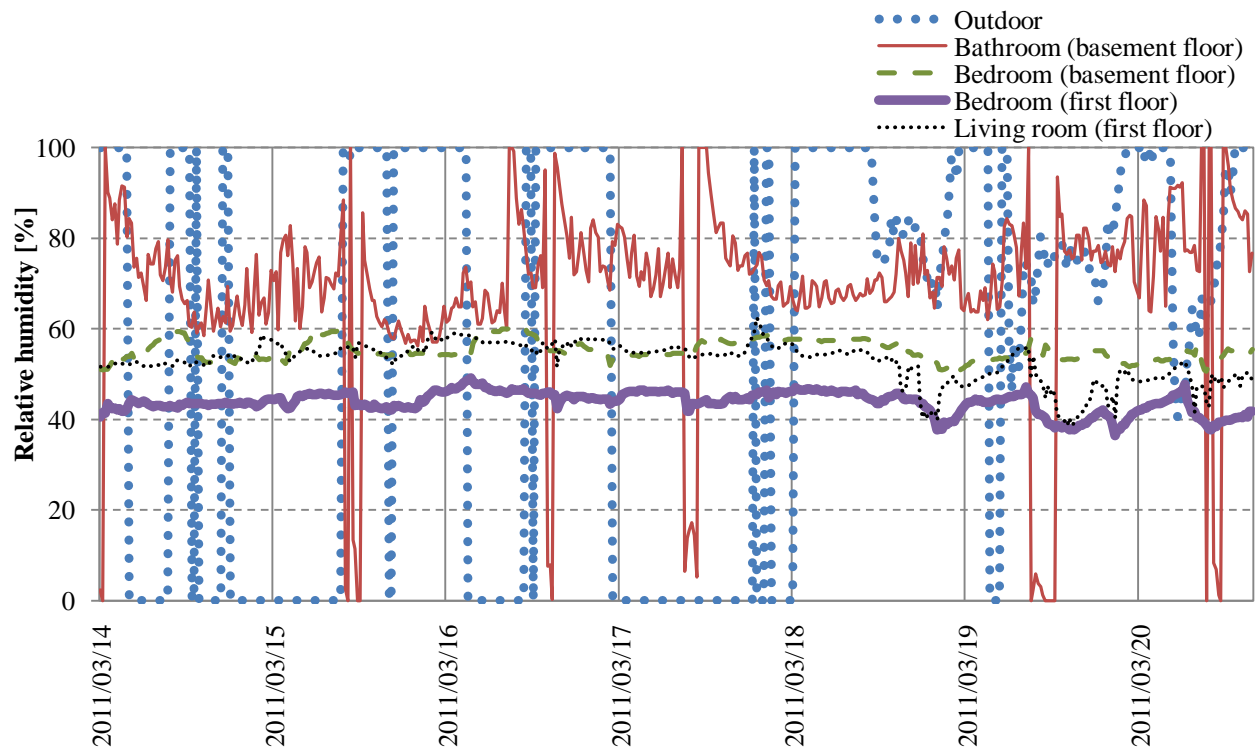


Fig. 25. Measured relative humidity in the warmest week of 2011 (based on a warmest hourly temperature measured outdoor, 33.9°C)

3.6.3 Interpretation of the results related to the indoor climate

The two weeks have been chosen to see the monitored temperature and relative humidity in the Blue House in period from Dec 12, 2010, to Aug 8, 2011. As example were chosen: one week with the coldest hourly temperature and one week with the warmest hourly temperature. Also the average temperatures and relative humidity during the whole period are shown. The coldest week shows the usage of the house and the warmest week shows possible problems with overheating.

The results from the coldest week show the following. The inhabitants probably do not use the bathroom in the basement floor, as the temperature is around 10°C in the coldest month March, 2011 (Fig. 22). The bedroom in the basement floor is probably not much used during winter time, i.e. the average temperature in the coldest week was approximately 10°C. The temperature in the living room fluctuates in relation to the outdoor temperature and there is a visible trend of the sunshine entering the room but there could be also influence of sun heating external wall where the sensors is located (Fig. 22). The smaller fluctuation of relative humidity shows that the bathroom in the basement floor is less used in winter time (Fig. 23) although it seems to be heated in winter (Fig. 22). The average temperature in the house is between 19°C and 21°C, and relative humidity in the house in winter varies between 20 - 40% (Table 4).

The results from the warmest week show the following. The relative humidity measured outside shows a probable malfunction of the sensor as the reading from the sensor shows 100% (Fig. 25). The humidity in the bathroom in the basement floor shows that the bathroom is used daily and that the temperature averages around 20°C. The average relative humidity in the bathroom is high even though the bathroom is not used, i.e. approximately between 65 - 75%. The temperature in the bedrooms differ approximately 4 - 5°C in the summer on the first and basement floor, i.e. varying from 18°C in the bedroom in the basement and around 22°C in the first floor (Fig. 24).

There are some problems with the TinyTags sensors regarding the position and obtained results. Although the sensor monitoring the outdoor is placed on the north façade, the sensor still can be influenced by the sun and moisture. The sensors in the interior are placed too close to the floor; ideal height and distances would be between 1 or 2 m of the floor and walls. At this point, the sensors measure more the surface temperatures.

3.7 Blower-door

3.7.1 Theory and equipment

The blower-door test is non destructive method used for determination of the air change rate of the houses through the building envelope. The test has to be made in depressurize and pressurize state to ensure that all openings in the building envelope are revealed. Further information about testing procedure and guidelines can be found in related manuals and the European Standard (EN 13829, 2001).

Testing equipment used for measuring of the air tightness of a building envelope of the Blue House is RETROTEC 2000 DOOR FAN with digital gauge DM-2 together with software Door Fan 3.0 Enclosure Leakage Analysis Software (version 3.247). The results are evaluated in accordance with EN Standard (EN 13829) and Danish Building Regulation as Greenlandic authorities has yet to introduce the limits on air tightness of the building envelope.

The infiltration rate is a volumetric flow of the outside air into a building V_{50} (m³/h) and the air change is the number of interior volume air changes that occurs per hour ACH (h⁻¹). The blower-door supplies the number to calculate the air change at 50 Pa pressure difference, i.e. n_{50} (h⁻¹). The air change is calculated in accordance with (1) where V_{net} is the internal volume (m³) for EN Standard comparison and/or as using (2) as defined as “SBI anvisning 213” method in the Danish Building Regulations (DBR, 2008) where q_{50} is the leakage rate (l/s/m²) and A_{gross} is the heated gross area (m²) (Aggerholm and Grau, 2008). The air change rate can be calculated using the Sherman method (3) with the internal floor area A_{net} (m²) and the corrected air flow (m³/h/m² or l/s/m²) (Sherman, 1987).

$$n_{50} = \frac{V_{50}}{V_{net}} \quad (1)$$

$$q_{50} = \frac{V_{50}}{A_{gross}} \quad (2)$$

$$w_{50} = \frac{V_{50}}{A_{net}} \quad (3)$$

The actual air change rate can be calculated using EN Standard method as in (4) where V_{n50} (m³) is the net air volume, V_{RAX} (m³) is the net air volume for pressurisation test, e is the wind screening coefficient according to EN 832 ($e = 0.05$) ((EN 832, 2000) and (EN 13829, 2001)). The actual air change rate (h⁻¹) at normal pressure can be calculated in accordance with (5) with the factor “20” using the “Princeton method” (Meier, 2011). This method gives reasonable estimates, but ignores many details of the infiltration process, such as stack effect, windiness and wind shielding and type of leaks. In comparison with the “Princeton method”, the “Sherman method” takes into account the different parameters influencing the infiltration (6) where C is the climate correction factor (26 (hot) < C < 14 (cold)); H is the height factor (1 = one-storey, 0.9 = 1.5 storey, 0.8 = 2- storey, etc.); L is the leakiness factor (1.4 = tight, 1 = average, 0.7 = not tight); S is the shielding factor (1.2 = well shielded, 1 = average, 0.9 = exposed). The values for the Blue House are: $C = 14$, $H = 2$, $L = 1$ and $S = 0.9$). The SBI method of finding the infiltration air change is by using the leakage rate at 50 Pa, q_{50} , and conversion (7) to a normalized pressure state (Aggerholm and Grau, 2008). The infiltration air change rate (h⁻¹) at normalized pressure is then found using the internal volume of the building V_{net} (m³) and the following equation (8).

$$n_{v,Res} = n_{50} \cdot e \cdot \frac{V_{n50}}{V_{RAX}} \quad (4)$$

$$q_{inf} = \frac{n_{50}}{20} \quad (5)$$

$$q_{inf} = \frac{w_{50}}{C \cdot H \cdot L \cdot S} \quad (6)$$

$$q = 0.04 + 0.06 \cdot q_{50} \quad (7)$$

$$q_{\text{inf}} = \frac{A_{\text{gross}} \cdot q}{V_{\text{net}}} \cdot 3.6 \quad (8)$$

3.7.2 Analyses of the blower-door results

The blower-door tests were performed on 8.8.2011, 9:00 (GMT -2, summertime) with the following initial data and boundary conditions (Table 5). The testing of air change was done using 12 steps with each step of 4.2 Pa, starting from 10 Pa to 60 Pa. There were total of 4 tests performed, i.e. two sets of pressurize and depressurize as a “Method A” with vents only closed, and “Method B” with vents sealed and taped over as in accordance with EN 13829. The three tests (depressurize “Method B”; pressurize “Method B”; pressurize “Method A”) were performed with range C6 and the fourth test (depressurize “Method A”) was done with range C8. The correlation factors were around 99%.

Table 5. Initial data and boundary conditions for blower-door tests

Initial data		Boundary conditions	
Net floor area A_{net}	183.76 m ²	Interior temperature	22.8°C
Internal surface area A_E	382 m ²	Outside temperature	14.0°C
Internal volume V	453.89 m ³	Wind speed	5 m/s
Elevation	37 m	Weather	sunny

Measured results from the blower-door tests with closed and taped vents (“Method B”) and with just closed vents (“Method A”) are the following (Table 6, Table 7). See attached blower-door tests in Annex E.

Table 6. Results from the blower-door test “Method A”

Data	Symbol	Result for “Method A”			Unit
		Depressurize	Pressurize	Average	
Air flow at 50 Pa	V_{50}	469.0	479.0	474.0	[l/s]
Air change at 50 Pa	n_{50}	3.72	3.80	3.76	[h ⁻¹]
Permeability at 50 Pa	q_{50}	1.23	1.25	1.24	[l/s/m ²]
Specific leakage rate at 50 Pa	w_{50}	2.55	2.61	2.58	[l/s/m ²]

Table 7. Results from the blower-door test “Method B”

Data	Symbol	Result for “Method B”			Unit
		Depressurize	Pressurize	Average	
Air flow at 50 Pa	V_{50}	386.0	401.0	393.5	[l/s]
Air change at 50 Pa	n_{50}	3.06	3.18	3.12	[h ⁻¹]
Permeability at 50 Pa	q_{50}	1.01	1.05	1.03	[l/s/m ²]
Specific leakage rate at 50 Pa	w_{50}	2.10	2.18	2.14	[l/s/m ²]

Furthermore, the infiltration heat loss was calculated to estimate the annual infiltration heat loss through the building envelope using the results from the blower-door test and the following equations. The total infiltration (EN 13790, 2004) throughout the year Q_{inf} (kWh/a) is expressed in (9) where V_{net} is the internal volume of the house (m³), q_{inf} is the calculated infiltration air change rate (h⁻¹), c_p is the thermal capacity of the air (1,005 J/(kg·K)), ρ is the air density (1.2 kg/m³) and HDH is the heating degree hours from Sisimiut.dry for Sisimiut (208 kKh/a).

$$Q_{inf} = V \cdot q_{inf} \cdot \frac{c_p \cdot \rho}{3,600} \cdot HDH$$

Table 8. Calculated air change (ACH) in neutral pressure using different methods and infiltration heat loss

Method	Air change [h ⁻¹]		Infiltration heat loss [kWh/a]	
	“Method A”	“Method B”	“Method A”	“Method B”
EN Standard	0.19	0.17	6011	5378
Princeton	0.19	0.15	6011	4745
Sherman	0.20	0.16	6327	5062
SBi Anvisning 213	0.16	0.19	5062	6011

3.7.3 Results for the blower-door

The results of air tightness of the building envelope show that the Blue House fulfils the Danish Standard request where the air permeability, or respectively q_{50} at 50 Pa pressure difference, must be below 1.5 l/s/m² (DBR, 2008). The air change rate at 50 Pa of the Blue House is approximately $n_{50} = 3.1$ h⁻¹ which is approximately 5 times worse than the requirements for a passive house (Passive House, 2011). Comparing with the standard wooden family houses in Greenland built in 1960s which have the air tightness varying from $n_{50} = 11.3 - 18.5$ h⁻¹, the Blue House presents a higher quality of younger buildings in Greenland (Bjarløv and Vladykova, 2011). In comparison to a newly built Low-energy house in Sisimiut with mechanical ventilation system with $n_{50} = 3.1$ h⁻¹ (Rode et. al, 2010), the Blue House represents a good example of a house with natural ventilation system.

Regarding to the Standards and the listed buildings in Greenland, the air tightness of the Blue House is quite high as it has a vapour airtight layer at the first floor and the concrete walls are rather tight themselves. For better comparison, it would be recommended to measure the air tightness using a tracer gas method which measures the natural infiltration at the normalized pressure state.

Results of the air change at neutral pressure are difficult to calculate from 50 Pa pressure difference to neutral pressure state. The presented methods have some boundaries but the results in Table 8 shows that the results are comparable. Furthermore, the infiltration heat loss is calculated and show in Table 8 showing that the infiltration heat loss varies from 4,700 – 6,300 kWh/a. This number should be compared to the ventilation and transmission heat losses. The air flow through the natural exhaust vents when closed is between 633 - 1265 kWh/a. This heat loss could be eliminated when the mechanical ventilation system would be installed in the Blue House.

According the blower-door testing using pressurize and depressurize, the building envelope of the Blue House is more open when the pressurize test is performed, i.e. when the outside air is taken through the

building envelope and blown out through the fan, see Table 6 and Table 7. The tightness of the sealing of the natural vents (only when they are closed but not taped over) can be simply estimated as difference between method A and B. These results in the following: air flow at 50 Pa of 82.5 l/s, or air change rate at 50 Pa as 0.64 h⁻¹ respectively (Table 8).

3.8 Thermography

3.8.1 Theory and equipment for thermography

Thermography testing is non invasive method for detection of the irregularities in the buildings structure and the detection of surface temperatures, i.e. heat loss sources, mould problems, irregularity of building insulation, location of defects in the ducting, etc.

The testing equipment used for performing a thermography test was an infrared camera HotFind-D and digital camera. The results were evaluated using ThermoView software and were evaluated in accordance with EN 13187 (EN 13187, 2011).

Two thermography tests were performed on: 8.8.2011, 12:00 (GMT -2, summer time) of the interior of the house with depressurizing of 50 Pa and the second test of the exterior of the house with neutral pressure was performed on 15.8.2011, 3:00 (GMT -2, summer time). The boundary conditions for both tests are listed in Table 9.

Table 9. Boundary conditions for thermography test

Elements	Thermography from inside	Thermography from outside
Interior temperature	22.8°C	22.0°C
Outside temperature	14.0°C	5.0°C
Wind speed	5 m/s	-
Weather - current	sunny	at night
Weather - 12 prior	sunny	cloudy
Temperature difference	8.8°C; not OK	17.0°C; OK

3.8.2 Results of thermography testing

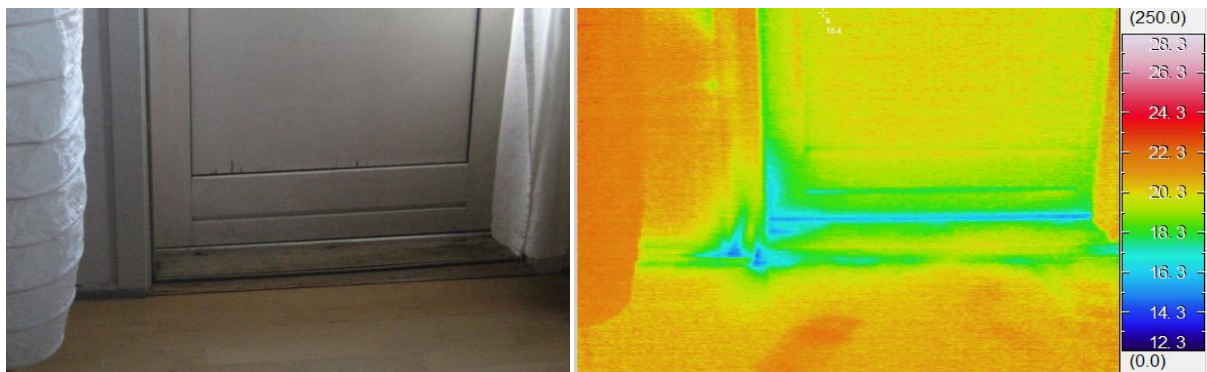


Fig. 26. Leaking balcony doors toward west in the living room

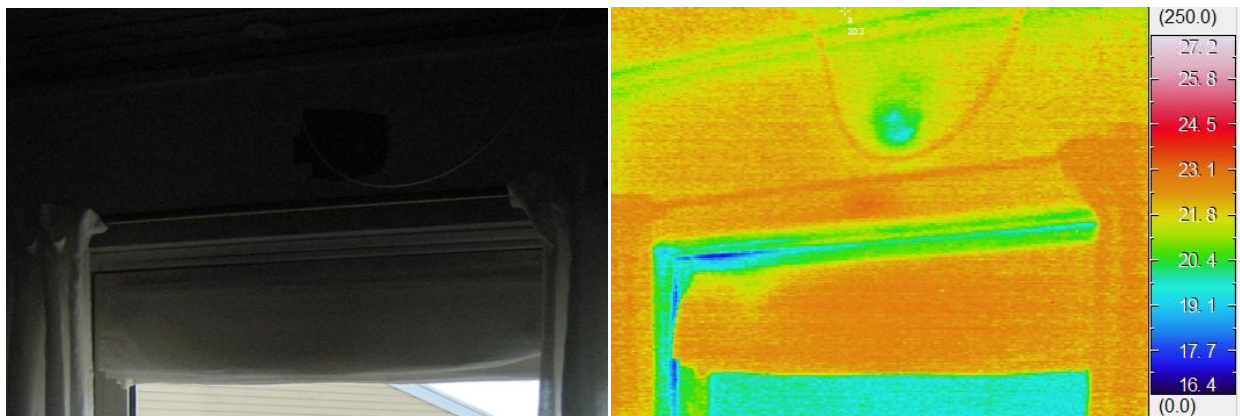


Fig. 27. Problematic window, natural vent and joints between wall and ceiling

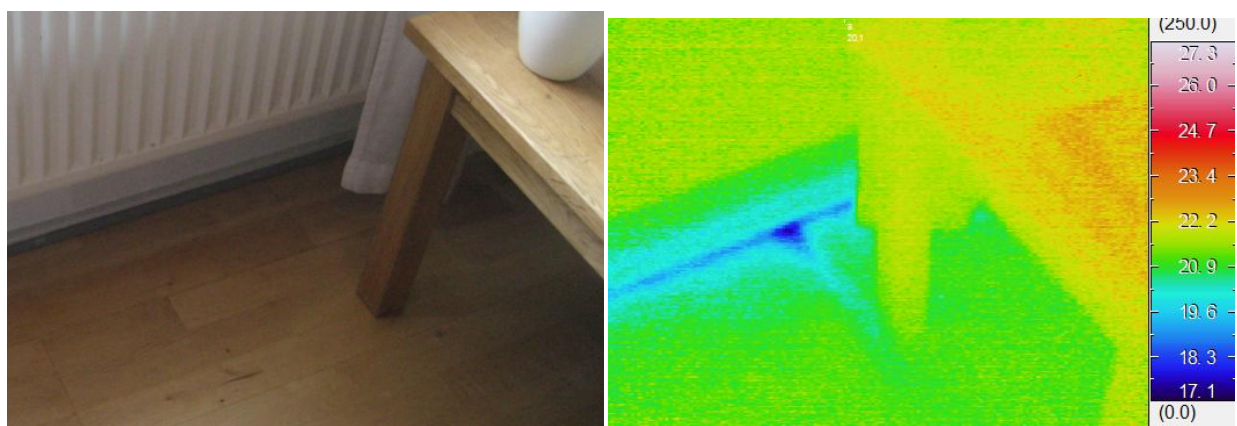


Fig. 28. Un tightness of the floor between concrete and wooden part of the structure in the living room

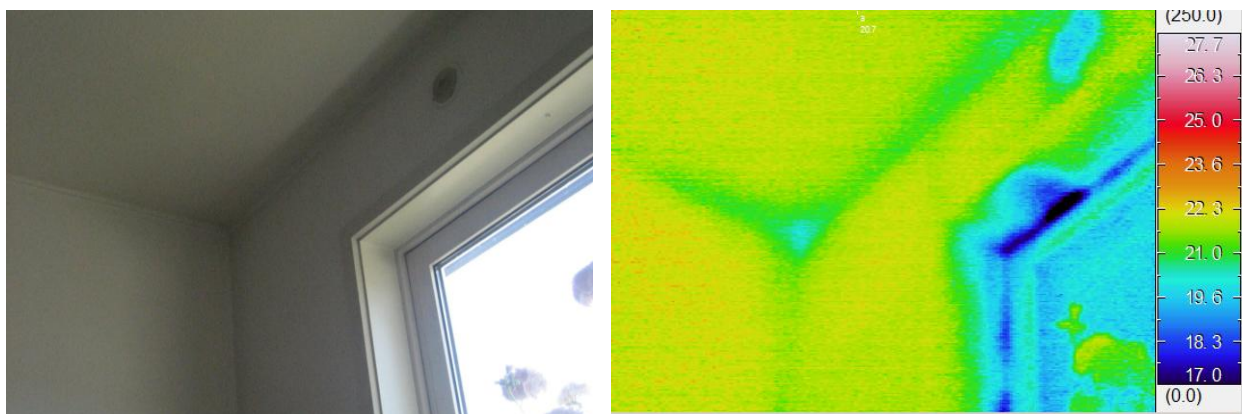


Fig. 29. Untight window and cold corner around the window in the basement / staircase

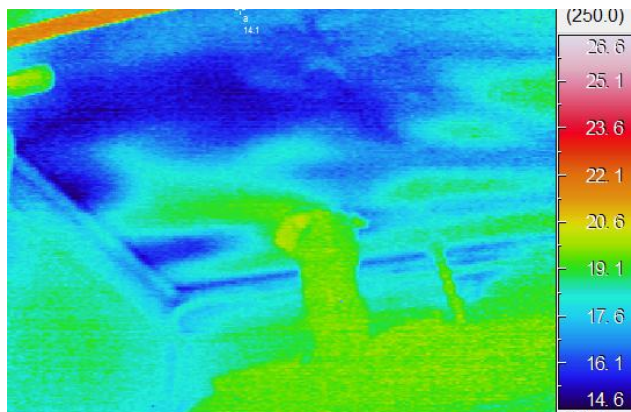


Fig. 30. Ceiling between two bathrooms, possibility of the humidity problems and cold floor

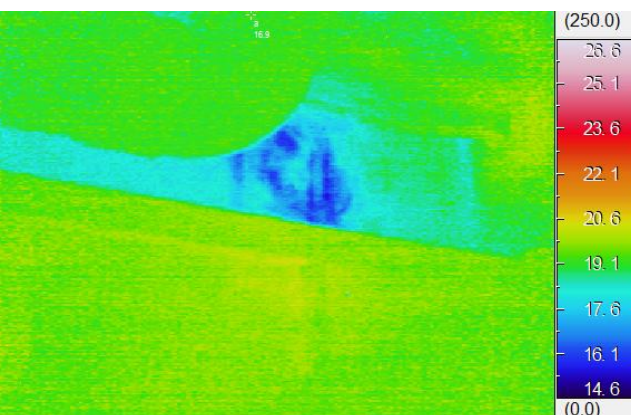


Fig. 31. Un tightness of the natural vent in the bathroom in the basement floor

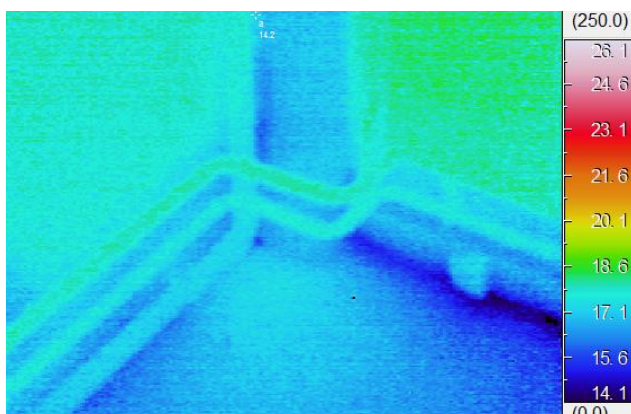


Fig. 32. Thermal bridge and cold floor along with corner in the bathroom in the basement floor

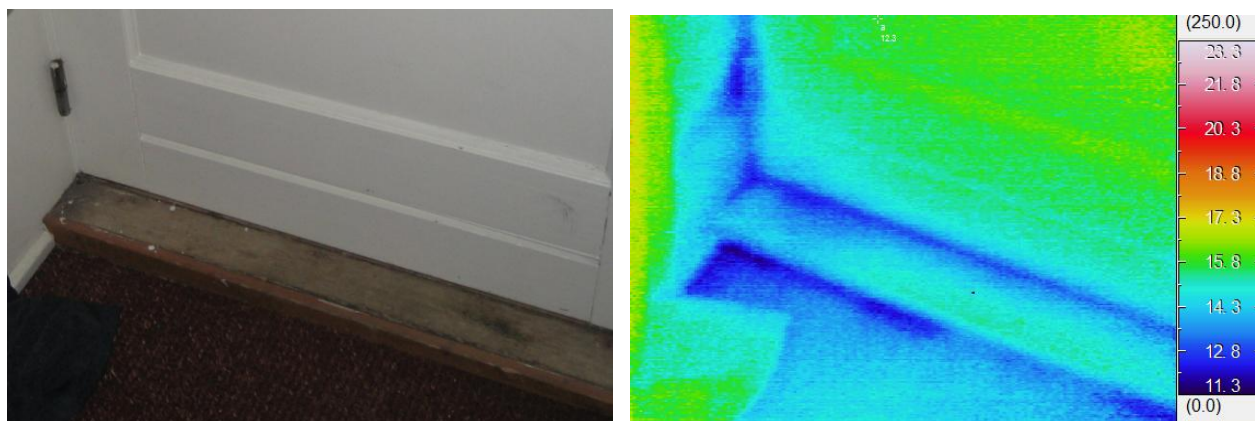


Fig. 33. Image of the problematic doors in the basement to the terrace (toward North, problem with freezing)



Fig. 34. View of the west facade of the Blue House

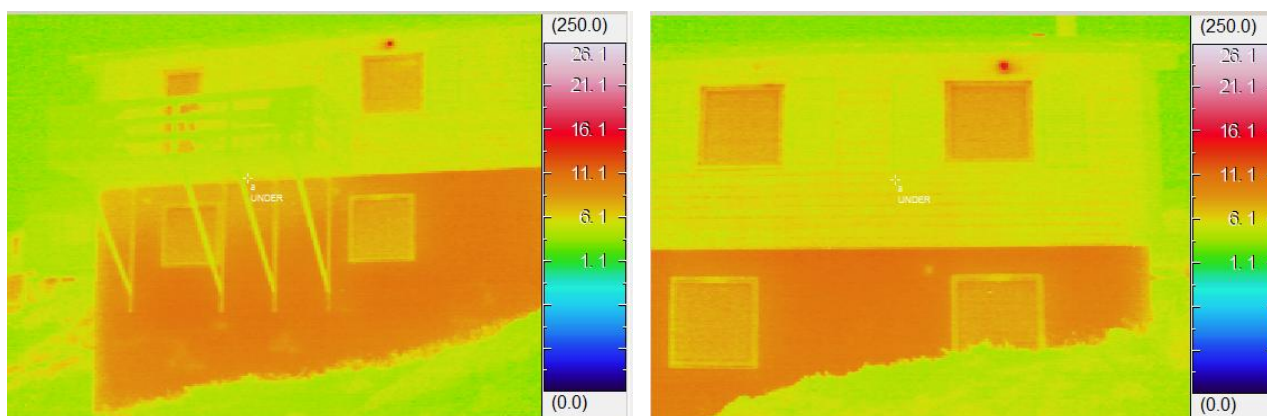


Fig. 35. Thermographic images of the west facade of the Blue House

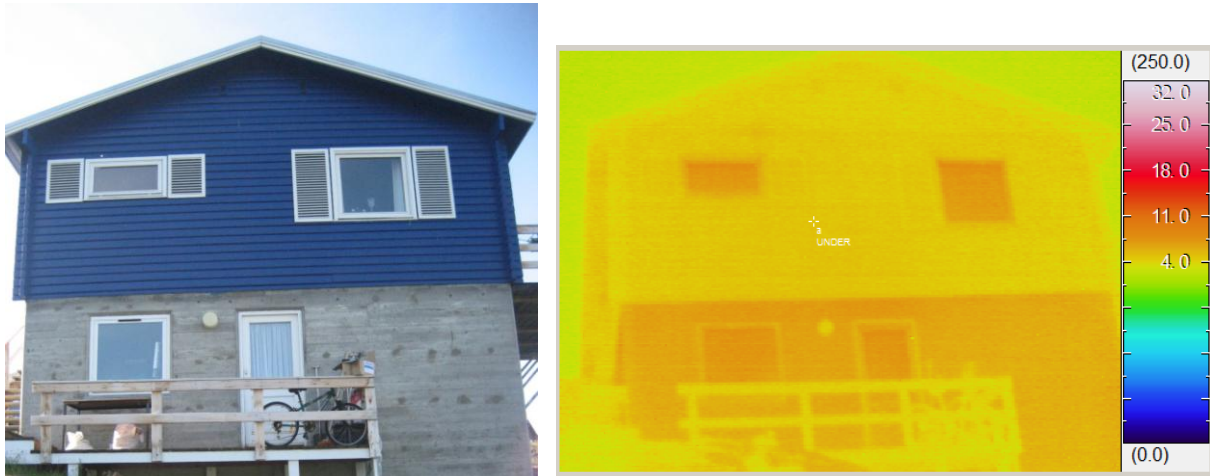


Fig. 36. View and thermographic image of the northern facade of the Blue House

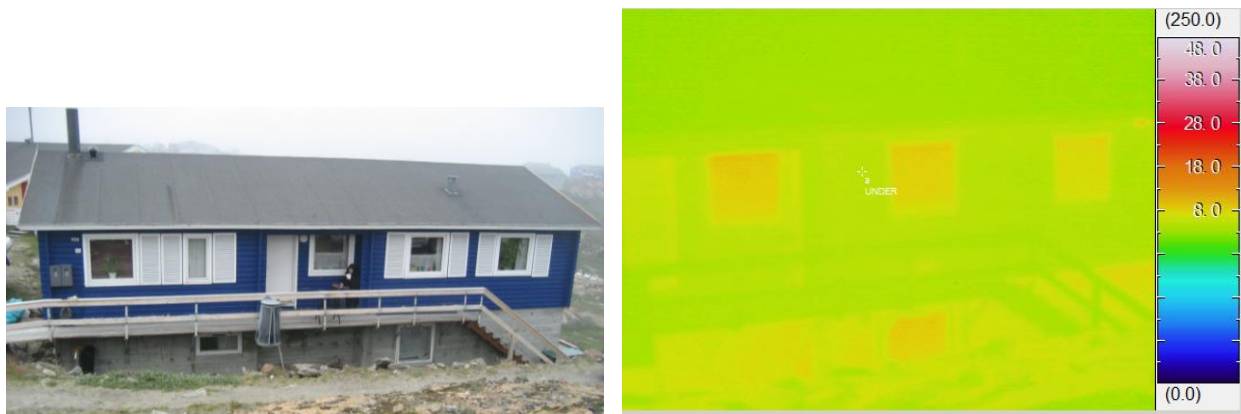


Fig. 37. View and thermographic image of the eastern facade of the Blue House

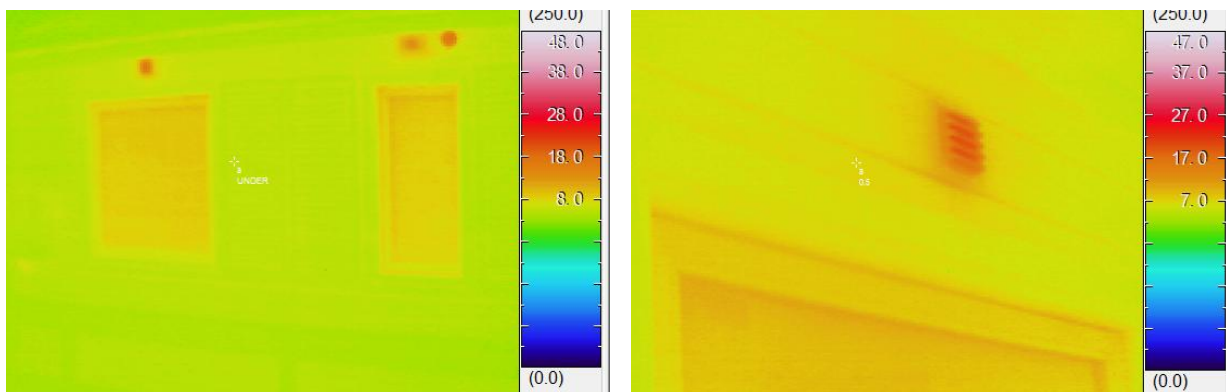


Fig. 38. Thermographic images of the details of the eastern facade

3.8.3 Evaluation of thermographic results

More pictures can be found in report (Vasilevskis and Silins, 2011). The results of the thermography investigation from the inside and outside show the following problems:

- the house has problems with the natural vents as they are sources of heat loss when they are closed and are not air tight and insulated as required (Fig. 38)
- the connection between upper wooden structure and lower concrete structure seems to be not air / wind tight and it is a source of heat loss, not continuance / sealling against the wind / air tight layer from wooden part to the concrete part (Fig. 28)
- there seem to be some problems in the floor in the upper bathroom / ceiling of the lower bathroom, possibility of the moisture in the construction (Fig. 30)
- cold floor in the basement, especially in the bathrooms (Fig. 32)
- untight balcony doors in the basement where there is a freezing problem in the winter (Fig. 26, Fig. 33)
- difference between wooden and concrete parts of the house (Fig. 35, Fig. 36)
- south facade was not diagnosed as it is mostly shielded from a boat

All problems revealed during thermographic investigation lead to a potentially high heat loss during the whole year with especially high heat loss during storms. The house seems to be rather tight but there is a significant difference between temperatures of basement floor and first floor, i.e. very cold floor of the basement. There are several untight and heat leaking windows and doors in the Blue house. The technical room and cold entrance in the basement are also sources of thermal heat loss and infiltration heat loss. It seems that the wind / air tight layer in the wooden part is working and basement floor is naturally air tight, but the connections / joints are the weakest points. Improvement of the wind / air tight layer and stabilisation of the whole structure is necessary before further insulation.

The temperature difference of minimum 10°C difference was not fulfilled but the thermographic test was used more as a guidance method to locate possible problems in the house such as air leakage or mould problems. Also, the house should have been retested in the winter period.

3.9 Energy consumption

3.9.1 Theoretical consumption

The theoretical consumption based on the Greenlandic Building Regulations (GBR, 2006) estimates that the house (located in Zone 2, north of the Polar Circle) with gross heated area of $A_{\text{gross}} = 209 \text{ m}^2$ should consume approximately $140.5 \text{ kWh}/(\text{m}^2 \cdot \text{a})$. This theoretical energy frame ($\text{MJ}/(\text{m}^2 \cdot \text{a})$) in for buildings is in accordance with (10) where e is calculated as heated area divided by a foot print area of a building.

$$\text{Zone2} = 510 + \frac{320}{e} \quad (10)$$

The oil consumption for the year 2010 was calculated from oil bills and it amounts to 2,935 litres per year. Yet, the year 2010 has been exceptionally warm, i.e. HDH = 162 kWh/a compared to DRY in which HDH =

208 kKh/a. The heating degree days were expressed using the following equation (11) where $T_{amb,out}$ is the average ambient temperature in each month and t_m is the number of hours in each month.

$$HDH = \sum (20 - T_{amb,out}) \cdot t_m \quad (11)$$

3.9.2 Oil bills and approximation of monthly oil consumption

The approximation of oil consumption based on information obtained from the oil bills (Annex F) is showed in Fig. 39. The approximation is based on the calculation of daily oil consumption which is calculated from dates of between two deliveries, and amount of delivered oil is divided by the number of days between two deliveries. This daily oil consumption in a relevant month is multiplied by number of days in relevant month. The oil consumption includes the space heating and domestic hot water consumption.

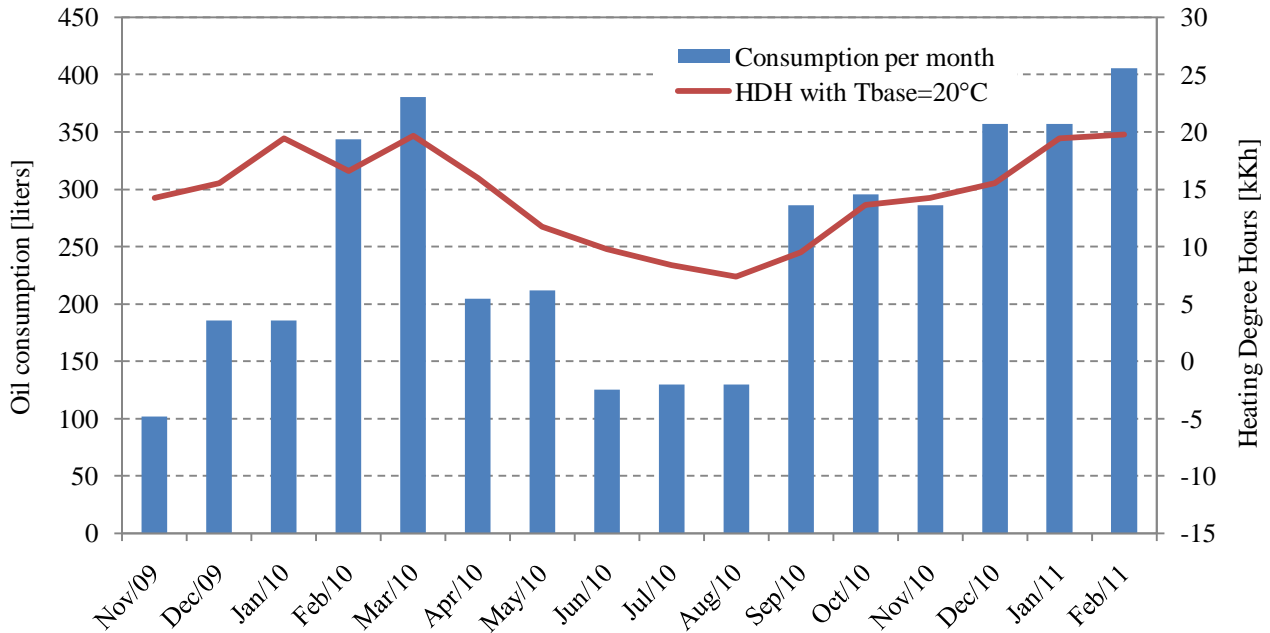


Fig. 39. Approximation of oil consumption based on oil delivered to the house

The current price for the oil is 4.27 DKK/litre (obtained from the heating bills), there has been an increase in the prices for oil of 1,10 DKK/litre in summer of 2011. The electricity is 3.28 DKK/1 kW. Assuming that 1 litre of oil gives 10 kWh, the house needs approximately 29,350 kWh/a for space heating and domestic hot water in the warmer year, i.e. 140.4 kWh/(m²·a) respectively. The hot water consumption is not measured separately therefore it can be only estimated based on standard consumption in Danish's homes as 250 l/m² per household per year (Aggerholm and Grau, 2008), $\Delta T = 45^\circ\text{C}$, and it is on average to 2.7 kWh/(m²·a) respectively. Only the heating consumption amounts to approximately 137.7 kWh/(m²·a) which is comparable to the today's GBR requirement but it is still rather high consumption.

4 Proposal of renovation using paper insulation

4.1 Application of paper insulation and problematic issues

Installation of paper insulation and additional buildings envelope layers will need to be designed and applied very carefully based on the experiences with weather conditions in Greenland, experiences with paper insulation and also based on the static security, moisture safety, etc. There are several issues related to the Blue House and the ambitious paper insulation listed as the following.

Before application of paper insulation

- The exterior painting needs to be sanded off (or removed with high water pressure equipment) before the application of paper insulation will begin as the painting now functions as vapour airtight membrane.
- Recommendation to make static investigation because of strong winds and so the new facade is not blown off. The static stability of old structure should be secured by fixed and tight iron cross beams where the wooden and concrete parts of the house will be fixed together with steel bar profiles.
- The floor in the living room has to be even up; approximately 50 mm in total of new layers for the floor has to be applied. The decision has to be made about the levelling of the basement floor.
- The thermal performance of the additional layer of paper insulation should be investigated using a detailed energy analyses. Furthermore, there is a recommendation to analyse the potential for condensation and drying off in the new structure at different locations in the building envelope.

Application of the new facade

- Cement-fibre profiles will be used for fixing of the current balconies and catwalk. They transfer less heat loss than normal steel members.
- The paper insulation will be blown in into the attic and applied to the external walls. There needs to be a decision if the crawl space beneath the house should be insulated.
- There is a goal of approximately additional 150 or 170 mm of additional layer of paper insulation. The thickness of the layer will be decided upon the physical possibilities of the current structure.
- As outer layer after paper insulation layer should be used a diffuse open material (towards outside) with good stiffness characteristics (composite material); this material will serve as a wind stopper; suggestions are such as a cement-chip board or a Cembrit board of 9 mm thickness or Amroc board of 8 mm from HBC (Holbæk Byggevarer Center) or Tyvek boards
- Paper insulation will be installed using the thermal breakers to lower the transmission heat loss and possible condensation around the fixings (Fig. 40).
- Along edges and around doors and windows and other openings shall be used sealant of a glue to make it wind tight, otherwise the air will come in between the board and wood when the structure will dry out. Also the profiles for assembling have to be sealed with sealant.
- It is the most important that no humidity will have access to the constructions, including penetration of fine drift snow.
- EPS insulation close to the ground will be installed to secure that the moisture from the ground will not be transported through the paper insulation, approximate height of 300 - 500 mm along the whole foundations.
- Possibly new windows depending on the budget will be fixed as the floating windows using the thermal breakers. Doors will be changed as they are not airtight, also depending on the budget.

- Possibly the heat exchanger should be installed in the house to provide a fresh air and save energy using recuperation. The corresponding bathroom and kitchen exhausts should be also fixed.

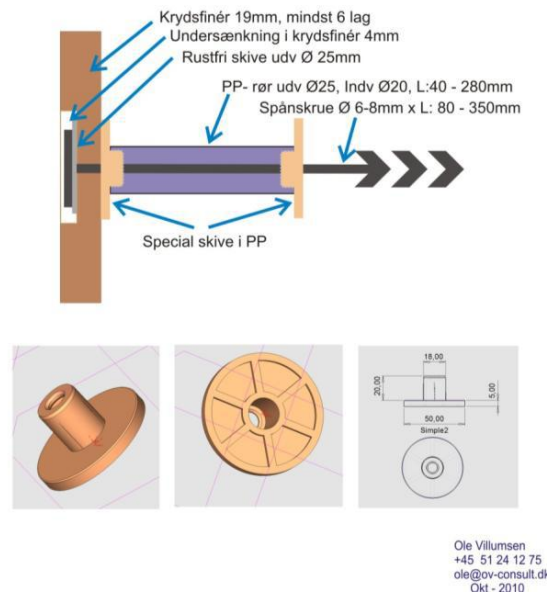


Fig. 40. Thermal bridge breaker for fixing the paper insulation and additional outer layer

4.2 Future follow-ups

Monitoring of paper insulation performance

The future follow-up on the performance of the paper insulation is recommended using a simple monitoring system. The additional paper insulation should be measured using a simple online system with in-built sensors which should monitor temperature, dew point and humidity at the different levels of the paper insulation, e.g. between today's outer surface of the concrete and new additional layer of the insulation; also the same for today's wooden part and new additional paper insulation; around windows, etc.

Documentation of energy savings and indoor climate

Furthermore, there should be continues collection of measured data in the Blue House (temperature, relative humidity, oil bill, questionnaires, etc.) to ensure the further documentation of energy savings achieve by application of the paper insulation and other building systems in the Blue House.

5 Acknowledgments

The gratitude is expressed to the Olsen family for letting us into the house and to all participants in measuring and documenting the house, namely Ulvis Silins, Sandijs Vasilevskis, Martin Kotol and Poul Linnert Christiansen. The gratitude is expressed to Ole Villumsen for his help with investigation.

The Blue House is part of the NEES project at ARTEK, Technical University of Denmark.

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Petra Vladykova	Research Assistant ARTEK, DTU Tel.: +45 60 83 21 55 E-mail: pev@byg.dtu.dk	responsible for investigations and report
Sandijs Vasilevskis Ulvis Silins	Bachelor students E-mail: sandijs.vasilevskis@gmail.com E-mail: ulvis.silins@gmail.com	drawings and investigations of the Blue House

8 Annex

A. Original drawings from Panbo A/S

Floor plan
Cross-section

B. Additional materials of the Panbo house provided by Panbo A/S

Material's description
Building the house
Material's list

C. New drawings

Floor plan of the first floor M 1:50
Floor plan of the basement floor M 1:50
Cross-section 1-1' M 1:50
Facade views M 1:100

D. Questionnaire with tenants

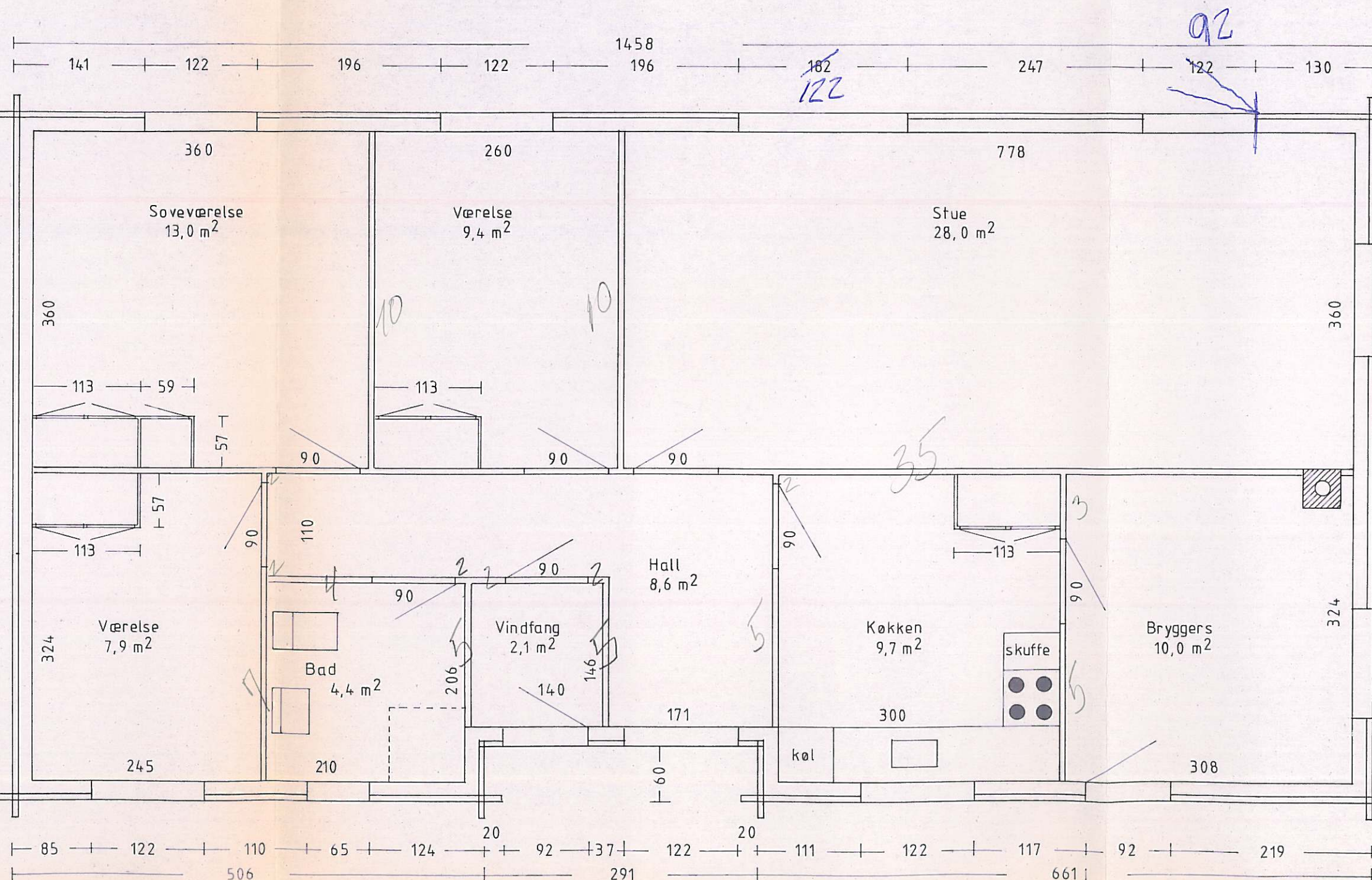
Provided by Martin Kotol, Ph.D. project: "Energy use and indoor environment in new and existing dwellings in arctic climates"

E. Blower-door tests

Depressurization, sealed, "Method B"
Pressurization, sealed, "Method B"
Depressurization, unsealed, "Method A"
Pressurization, unsealed, "Method A"

F. Oil bills for space heating and hot water consumption

Period from Sep 2009 until Mar 2011



Køkken	200 cm ²
Bad	150 cm ²

Ydervægge	22 cm
Skillevægge	7,8 cm

MARTIN JOHNSEN
SYGEHUSET
DEICHMANNSVEJ
39 II HOLSTEINSBORG.
GRØNLAND.

Panbo Huse A/S
Højen, 7100 Vejle
Tlf. 05-863080

TAG :

Svejsepap RF (Grønlandskvalitet)

Underlagspap, svejse — " —

Icopal svejsestrimler

16 mm vandfast krydsfinér

Spær: Hydro Nail i flg. beregning pr. 80 cm

Forankring af spær: 2 stk forankringslægter

pr. spær, dog forankres hvert sjette spær

med 2 stk BMF-bånd, der føres

ned og fastgøres til før-

ste bjælke.

20°

Gangbro 1'x4"

60x90 cm lofttlem

Krydsfinérpladerne påsømmes spærerne med

40/50 kamsøm pr. 15 cm.

Pladerne lægges med et spærs forløb pr. række

LOFT : (k=0,19)

200 mm mineraluld A+B

1" hv. og pl. loftforskalling pr 40 cm påsømmes hvert spær med 2 stk 3" søm

Plasticfolie 0,07mm

9 mm krydsfinérpl. påsømmes med 18/35 galv. søm pr. 15 cm.

Ydervægge (k=0,24)

3"x6" hv. og pl. tømmer

1 lag isoleringspap

150 mm mineraluld A-batts

2"x4" + 2"x2" hv stolpeskelet med rem 2x4 (i flg. Træ 5 og 25)

Om bad dog trykimpr. stolpeskelet

Plasticfolie

13mm gipsplader påsømmes lægteskelet med 18/35 galv. søm pr. 15 cm.

Hver tredje bjælke fastgøres til ydervæg med 2 stk

BMF-Vinkelbeslag 90 sømmed med 3 stk 40/40 kamsøm

pr. flig i bjælke og 6 stk 40/40 kamsøm pr. flig i

ydervæg.

Skillevægge:

2"x2 1/4" stolpeskelet (om bad trykimpr.)

50 mm mineraluld B-batts

9 mm krydsfinér

Vægge i bad:

PVC beklædning

10 mm impr. spånplade

Trykimpr. stolpeskelet pr. 30 cm

Gulv i bad og bryggers:

PVC belægning

22 mm impr. spånplade

Ikke plastikfolie under gulv i bad og bryggers og i vægge i bad

Gulv : (k=0,22)

22 mm spånplader

Plastikfolie 0,15 mm

2"x8" bjælkelag pr. 50 cm

200 mm mineraluld A-batts

1 lag isoleringspap

1" spredt forskalling

3x30 mm galv. jernankre støbt 25 cm ned i betonen pr 1 m og fastgjort til de 2 nederste bjælker med 3 stk 12/75 franske skruer, længde ialt 70 cm.

Hver tredje bjælke samles med 2 stk BMF hulplader 50 x 200 mm. Hver plade sømmed med 2x3 stk 40/40 kamsøm.

T 18 pr 2 m

T 18 pr 2 m

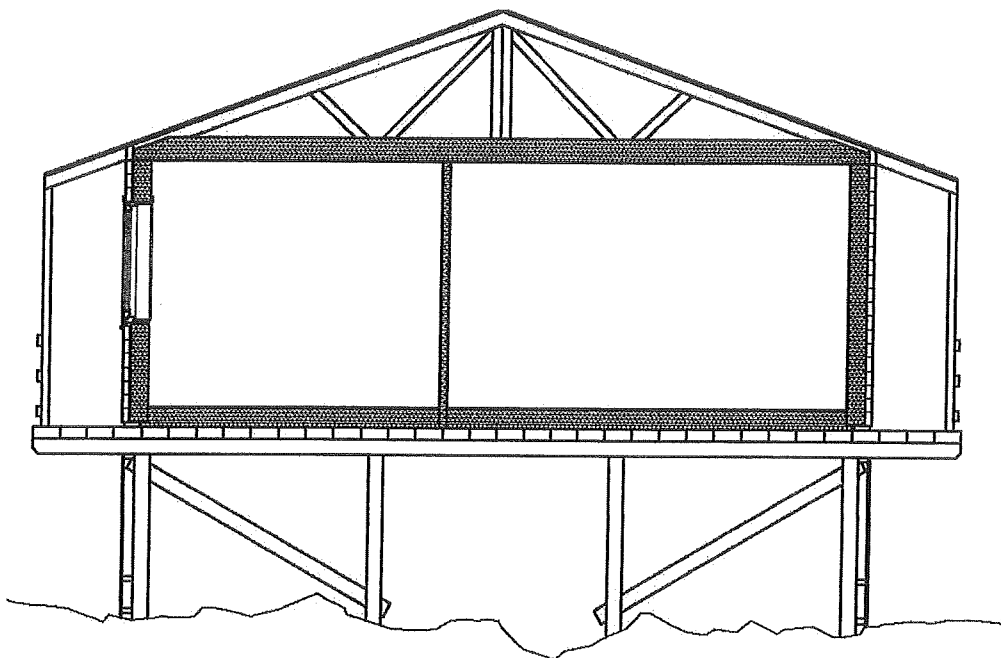
Snit-mål 1:20

Materialebeskrivelse

Fundament:

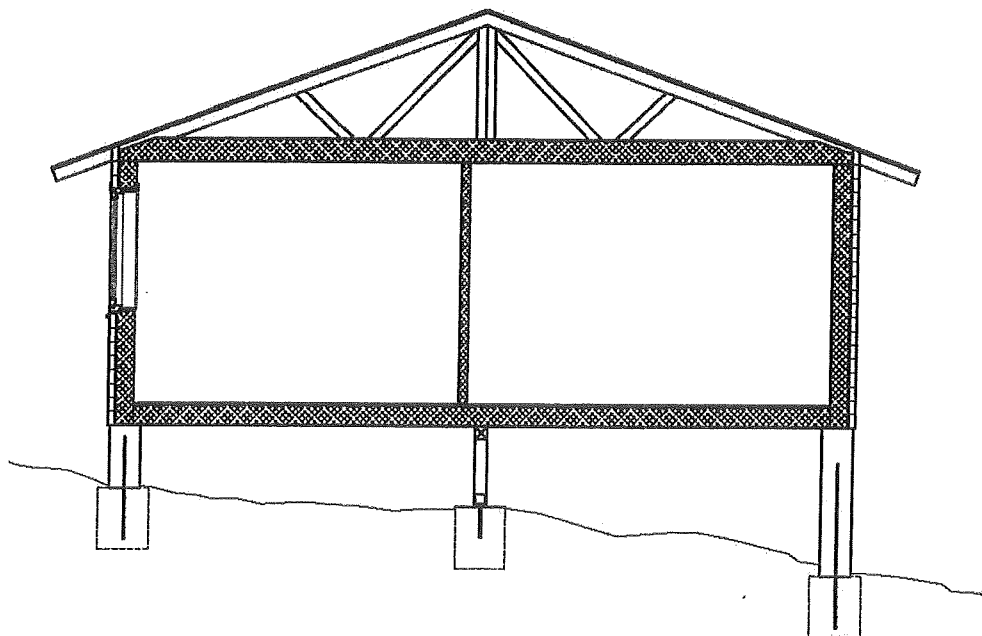
1:

Fundamentet udføres som stolpefundament med bærebjælker og massivtræsdæk. Stolperne beklædes udvendigt med krydsfinerplader.



2.

Betonfundament. Gulvopbygning er da med bjælkelag, 200 mm isolering mellem bjælkerne og forskalling underne til fastholdelse af isoleringen.



Gulve:

Gulvet udføres af 200 mm trykfast isolering og 22 mm spånplader. Gulve i stue, køkken og værelser belægges med laminatgulv. Gulvbelægning i bad og fyrrum/bryggers er vinyl.

Ydervægge:

Ydervæggene udføres med 70 mm ydervægsbjælker, 45x120 mm stolper og 45x45 mm vandret stræk. Indvendig beklædes med 8 mm krydsfiner og 13 mm gipsplader. Ydervægge isoleres med 165 mm mineraluld.

Skillevægge:

Skillevægge udføres af 45x55 mm skillevæggsstolper isoleret med 45 mm mineraluld og beklædt på begge sider med 8 mm krydsfiner og 13 mm gipsplader. Skillevægge indgår ikke i det stabiliserende system og kan derfor placeres efter ønske.

Loft- og tagkonstruktion:

Loftbeklædningen er 40x60 cm gipsfliser. Tagplader er krydsfiner med pålagt asfaltpap. Samlinger strimles og klæbes med kold asfalt. Overpappen svejses på. Gitterspær med 20° taghældning. Spærene leveres i 2 halvdele. Isoleringen er 215 mm mineraluld.

Vinduer:

Vinduer er CE mærkede og udstyret med Energiglas A. Vinduesbænke er limtræ.

Yderdøre:

Yderdørene er isolerede og plankebeklædte. Ruden i dørene er kvadratisk skråtstillet.

Indvendige døre:

Indvendige døre er lamel-egefinerede.

Skabs- og køkkenelementer:

Skabs- og køkkenelementer er lyse lamelfinér og slidstærke bordplader med tilhørende vask.

Malermaterialer:

Til udvendig træværk leveres oliebaseret maling i følgende farver: Almueblå, vogngreen, svenskrød og skagengul.

Maling til indvendige overflader er lyse alkydprodukter.

Afløb:

Afløb er jernrør, som isoleres og føres uden for fundamentet i en udløbstud.

Vand:

Brugsvandsinstallationer er helåds vand eller vandtank forsynet med selvansugende Jetpumpe. Det varme brugsvand produceres i en varmtvandsbeholder indbygget i centralvarmekedlen.

Varme:

Huset opvarmes ved hjælp af et centralvarmeanlæg forsynet med radiatorer. Kedlen er forsynet med oliefyr og cirkulationspumpe. Kedlen har røgafgang i toppen og skorstenen er en elementskorsten med rustfri stålkappe. Olie tanken er på 600 liter.

Alle centralvarme- og olie rør er kobber rør eller plexrør, som samles uden gevindskæring eller lodning, således at selvbyggeren selv kan samle rørene.

El-installationer:

El-installationer udføres med kabler i kabelbakker anbragt ved loftet.

Fra Panbo leveres materialer til el-installationer samt køleskab, komfur og emhætte.

El-installationer tilsluttes af autoriseret el-installatør.

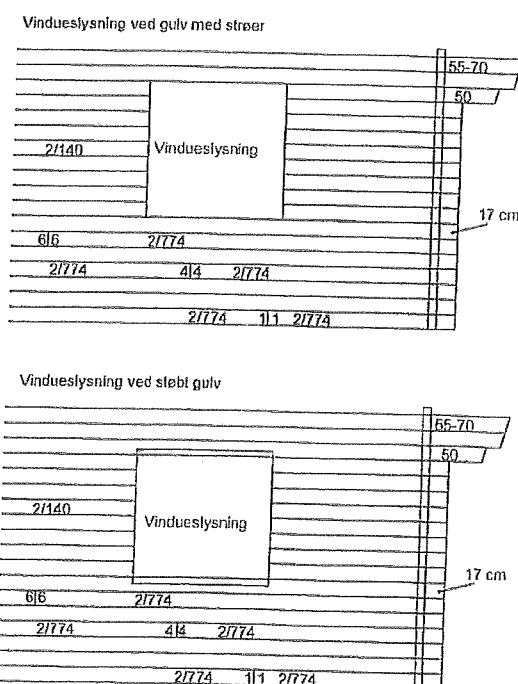
Værktøj:

Værktøj og sikkerhedsudstyr leveres til alle huse.

OPSTILLING AF HUSET.

Når huset leveres, medfølger der en konstruktionstegning. Herpå er der en plan med et sidenummer til hver af husets sider. Et tilsvarende nummer står på bagsiden af ydervæggens tømmer, desuden er bjælkens længdemål og ved stødene også bjælkens nummer i højderetningen anført. Der kan f.eks. stå 2/774. Det første tal "2" angiver den side, hvor tømmeret hører til, og det sidste tal "774" angiver den samlede længde på bjælken. Se tegning nedenfor. Da ydervæggens tømmer ikke kan leveres i uendelige længden, vil der opstå enkelte sammenskæringer eller stød. Ved hvert stød er bjælkens højdenummer angivet. Sørg også for, at disse numre passer sammen. Se tegning. Ved sammenskæringerne er bjælkerne opslidsede i enderne. I disse slidser anbringes krydsfinersløjfer, som ligger i en af pakkerne med ydervægsbjælker.

Inden opstillingen begynder, må alle bjælker sorteres ud til de sider, hvor de skal bygges op. Læg alle numrene opad. Murfolien/sokkelpappen rulles ud til kanten af fundamentet. Herpå anbringes den første bjælke, som rager 2 cm ud over såvel sokkelpap som fundament. De vil nu opdage, at der ikke går lang tid, før huset er i rejsehøjde. Ved enfamiliehuse og sommerhuse har facadesiden 18 bjælker i højden. Vedrørende vindueslysning i facade – se nedenfor. I vindueshøjde skal der foretages en opretning af bjælkekonstruktionen. De må endelig bruge en lodstok, så opretningen bliver helt nøjagtig. Er huset nu lidt ude af lod, rettes det op ved at slå på de udragende bjælkeender, skiftevis i hver side, indtil alt er korrigeret. På samme måde drives evt. stød mellem bjælkeenderne sammen. De første 15 bjælker har en udragende ende på 17 cm, målt fra knudesamlingerne, bjælke nummer 16 har en udragende ende på 50 cm og bjælkerne 17 og 18 en udragende ende på 55-70 cm, der skal bruges til understøtning af udhængsspæret. Når hele konstruktionen er sat op og står lige, skal den afstives med skrålægter og 4,5x12,0 cm stolperne, der hæftes på ydervæggen eller fastholdes med skruetvinger ved vindues- og døråbningerne, se side 5. 4,5x12,0 cm stolperne skal først anvendes igen, efter taget er færdigt og isoleringspappen er hæftet på.



Spær:

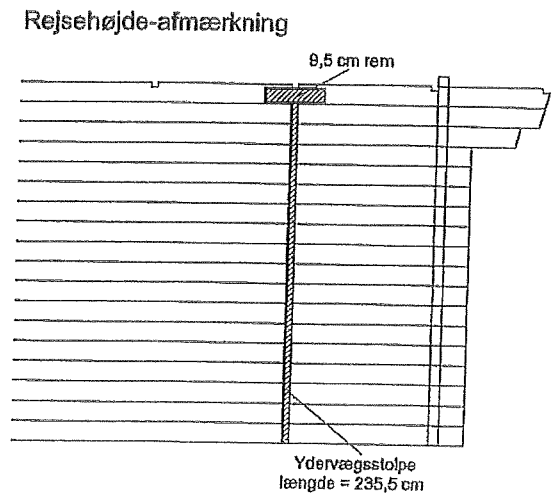
Inden oplægning af spærene, må man sørge for, at husets ydervægge både vandret og lodret er lige. Er det en lang væg, må der ud over skrålægter støttes med skråstivere og alm. afstivning. (Læs også nederst side 4 og se billeder side 5). Først afmærkes på begge ydervægge, hvor spærene skal stå. Afstand fra midte til midte af spær står på konstruktionstegningen, som følger med huset. Derefter skal der saves og stemmes ud for spærene i den øverste bjælke.

Vægstolper og rem måler: $235,5 + 9,5 = 245$ cm.

Dette mål skal der være fra overkant fundament til underkant spær.

Til at fylde ud mellem spærene medfølger stykker af ydervægstømmer på ca. 1 meter. De skal saves til, så de passer i længden og placeres når alle spær er rejst.

Før De sætter spærene op, er det en god ide at strege af til lægtning. Her er det vigtigt, at De er **MEGET** nøjagtig, og at spærene ligger fuldstændig lige oven på hinanden. Gør de det, kan De nemlig strege af til lægtning på alle spærene på en gang, og De slipper for at afsætte stregerne, når spærene er sat op.



Spæropsætning:

Spærene kommer samlet fra Panbo's fabrik.

Når det første spær er rejst, sørg da for, at det støttes godt til sidevæggene med et par lægter. Det første og det andet spær sømmes sammen med en lægte nær kippen, og der fortsættes med flere lignende lægter efterhånden som de øvrige spær kommer op. Kontroller også at afstanden mellem 2 spær er den samme ved kip og fod. Når man har oplagt 3 spær, er det klogt at give ekstra sidestivhed med en skrålægte på begge sider af taget - indvendig. (Se billede nederst side 7).

Vindgitter:

Når alle spærene er på plads, sømmes vindgitter på. Vindgitteret består af taglægter, som sømmes på spærhovedets underside. (Se skitse side 7).

Gavltrekanter:

Er alle spærene på plads, skal ydervæggens bjælker op i gavltrekanterne. Bjælkerne fastgøres fra den

Type: 1

107 m². *Lyngsøvej, 3911 SE. neret*

1	udvendig tømmer, høvlet og pløjet 3x6"	<i>ikke 107 m² kun</i>		
2	spær 7,36 el. 8,00 m. pr. 80 cm. stk.	<i>19</i>		
3	udhængsspær 2x5"	<i>4/450</i>		
4	vindskeder 1x4"	<i>4/450</i>		
5	taaplader, 16 mm finer med not og fer	<i>52-54</i>		
6	pap A, svejse, overpap sort 1,00x10 m.	<i>17 ruller</i>		
7	pap, svejseunderlagspap 1,00x10 m.	<i>17 -" -</i>		
8	svejsestrimler 0,15x10 m.	<i>3 -" -</i>		
9	stolper til ydervæg 244 mm. 2x4"	<i>80 stk.</i>	<i>6</i>	
10	væddet stræk til ydervæg 2x2"	<i>210 m.</i>	<i>15</i>	
11	ram over stolper 2x4"	<i>40 m.</i>	<i>4</i>	
12	mell.stk. over/under døre/vinduer 2x4"	<i>12/22 4/16 6/12 m.</i>	<i>2/65</i>	
13	mell.stk. til ydervæg 3/4x2"	<i>275 stk.</i>	<i>25</i>	
14	loftforskalling 1x2 1/2"	<i>300 m.</i>		
15	mell.stk. til loftforskalling 1x2 1/2"	<i>300 stk.</i>		
16	forankring af spær og gavle 5x5x40 cm.	<i>50 stk.</i>		
17	løfter til fastgørelse af vindpap	<i>70 m.</i>		
18	forskall. 3/4x4" fastgørel mell. spær	<i>30 m.</i>		
19	H.M.P. vindtrækbånd 2x40 mm.	<i>1 rulle</i>		
20	loftpap	<i>2 1/2 -" -</i>		
21	vindpap til ydervæg og loft, i ruller.	<i>7 rull. 1/papsøm</i>		
22	palstrikfolie 0,07 mm. ydervæg og loft	<i>3 rullet</i>		
23	forskalling under bjælkelag	<i>250 m.</i>	<i>260</i>	
24	bjælkelag pr. 0,50 m 2x8"	<i>60/360</i>		
25	søm til taaplader, kantsøm 40/50	<i>8 pak. a 250 stk.</i>		
26	søm til stolper, skillelv. og loftforsk.	<i>1800/4" 4/100/3"</i>		
27	søm til vægbelægning og gerikter	<i>3000/18/35 400 1/2 dyk.</i>		
28	søm til gulve	<i>1000/3"</i>		
29	søm til indsatning af vinduer og døre	<i>200/4" dyk.</i>		
30	søm til fodlister, sætning af køkken	<i>400/2" dyk.</i>		
31	125" til vægbelægning i forendst.	<i>35 m.</i>		
32	600" 10x90 til vindelplader.	<i>20 stk.</i>		
33	" til vægbelægning i forendst.	<i>4 -" -</i>		

*Kjeld
Dahl*

Materialeliste over 2. levering til Grønland, *Havn Charles* empræg-

dato: 26.8.85.

Type: 1

107 m².

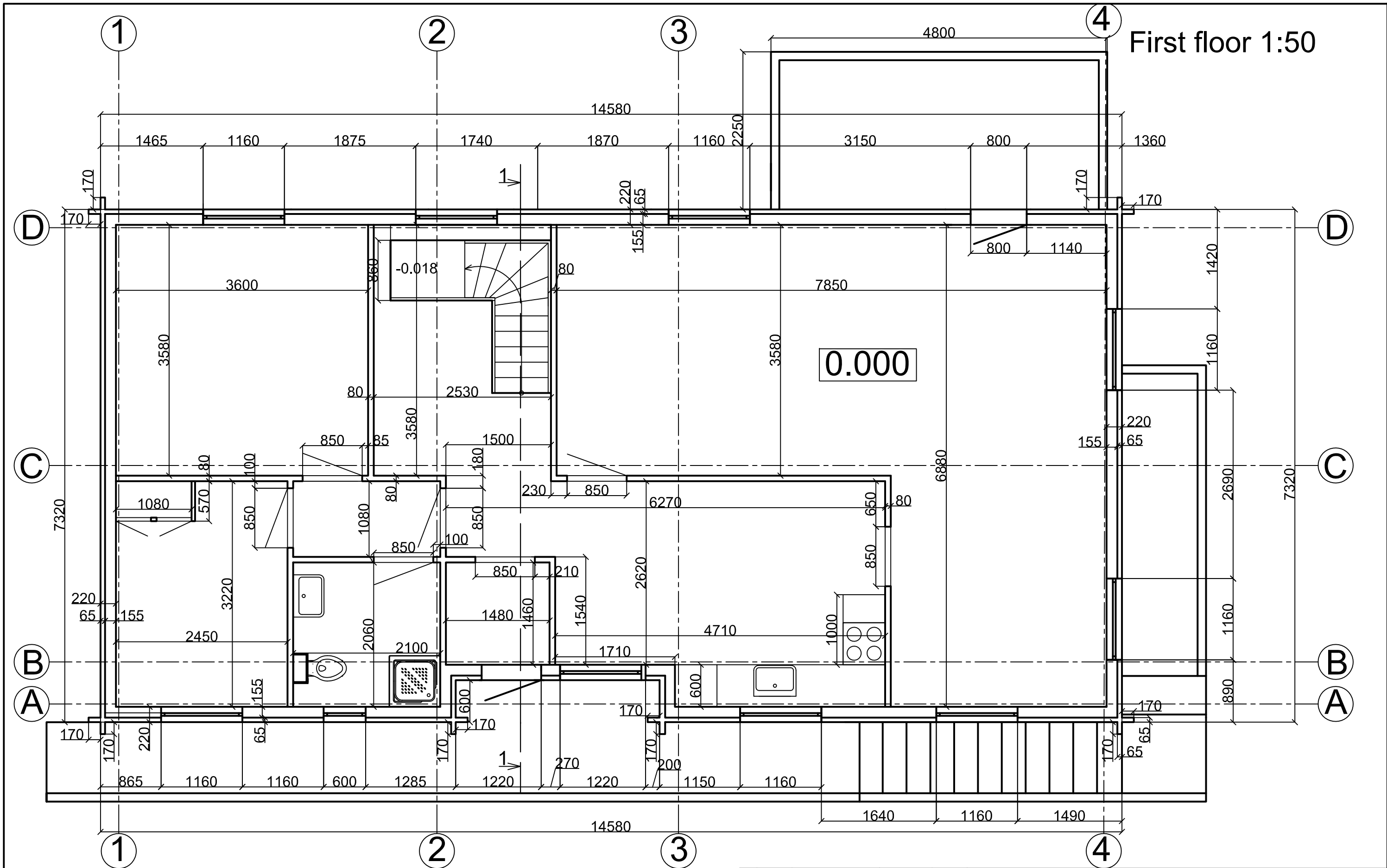
3911 Grønland neret

30	skillevægspolper	45x55x233 cm.	84	20		
31	mell.stk. skillevæg. og dørøverliggere		150 + 7/90	1/90 30		
32	lyder, over og under skillevægge		66	14		
33	isolering til skillevægge	50 mm. B.	15 m ² 7 pk. a 10,80 m ²			
34	isolering til ydervægge	50 mm. A.	86 m ² 8 pk. a 10,80 m ²			
35	isolering til ydervægge	100 mm. A.	86 m ² 16 pk. a 5,40 m ²			
36	isolering til loft	100 mm. A.	108 m ² 20 pk. a 5,40 m ²			
37	isolering til loft	100 mm. B.	108 m ² 20 pk. a 5,40 m ²			
38	isolering til gulv	2x100 mm. A.	125 m ² 36 pk. a 5,40 m ²			
39	krydsfiner til loft, 122 x 244, 9 mm.		30 plader			
40	krydsfiner til alle indv. vægge 9 mm.		50 - " -			
41	skilvægge vandfast finer el. spånpl. i bad 9 mm.			7		
42	vinduer med thermoglas	180x114 cm.	0			
43	vinduer med thermoglas	120x114 cm.	6			
44	vinduer med thermoglas	63x114 cm.	1 + 2 liggende			
45	glasklodser og gummistrimler		50 stk. + 90 m.			
46	saalbænke 1x3" med skruer	2/114	0/180 6/120 1/63			
47	udv. dør m. rustikbeklåd. 90x204 cm.		2 = 1 H + 1 V. = byggerdør			
48	udv. dør m. thermorude	90x204 cm.	0			
49	skilvægge byggerdør med rustikbekl. 90x204 cm.		1 V. m. glas i øverste halvdel			
50	havedør m. thermogl. enkelt 90x204 cm.		0			
51	havedør m. thermogl. dobb. 130x204 cm.		0			
52	udvendige dørgreb		2 / smedegreb 1 / alm.			
53	udvendige gerikter	6/217 0/190	0/140 22/132 6/100	5/75		
54	tilsætninger til 22 cm. ydervæg	6/217	0/190 0/140 24/132 3/100	5/75		
55	rustik til loft i vindfang		37/55 0/95			
56	loftlem		1			
57	værk, el. fugefilt, el. "Seco" skum,		16 plader			
58	gipspl. 13 mm til bagside af ydervægge		35 stk.	32.		

Dato:

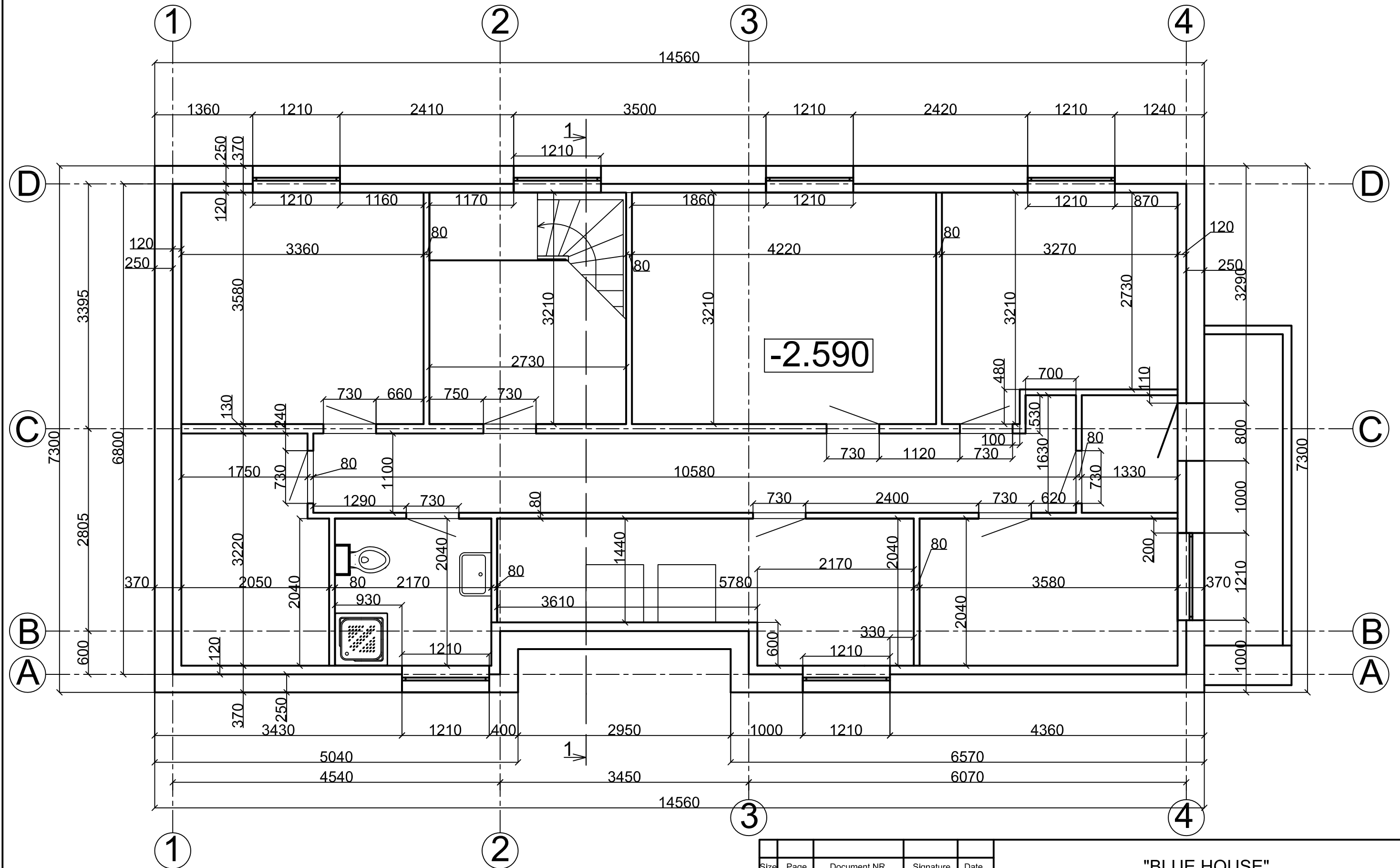
$$m^2$$

			neret		
60	skodder	58x125 cm.	11		
61	skodder	58x75 cm.	4		
62	skodder	62x212 cm.	0		
63	indvendige døre	90x208 cm. 86x208 cm.	8 11 11		
64	gulve, 22 mm spånplade m. fer og not		101 m ² = 70 yd.		
65	lim til gulvenes fer og not, frostfri		4 flasker		
66	vindpap under gulv		5 ruller		
67	køkken med skuffebord,		0		
68	overskabe		0		
69	skabe enkelte	59x59x235 cm.	0 /h 1/v		
70	skabe dobbelte	59x113x235 cm.	4 eg		
71	gavle	56x235 cm.	6		
72	hylder, store	54x112 cm.	8		
73	hylder, små	54x 58 cm.	5		
74	lister til samling ved skabe 235 cm.		1		
75	lister til afstivning af dobb. skabe		4 /170		
76	bøjlestanger + ophæng		4/120 0/60		
77	vinduesbanke, lamineret/massiv		0/190 5/130 0/75		
78	hyldeknagte + skruer		12		
79	foð - og loftslister		140 + 140 - 100. 100		
80	fejellister	0/130	19/90 0/80		
81	indvendige gerikter	38/217 0/190	0/140 24/132 9/100 6/73		
82	indvendige dørgræb		8		
83	skabslåse		ja		
84	skuffegræb		ja		
85	22 mm spånplade til gulv i bad, 60 x 240,		4		
86	rustikbrædder til loftbeklædning i stue		= 28 m ² = 43 / 810		
87	Tavle til dag, gæst, Børst 4.				
7 Lkh. Side. Udsættelser (Antik)					



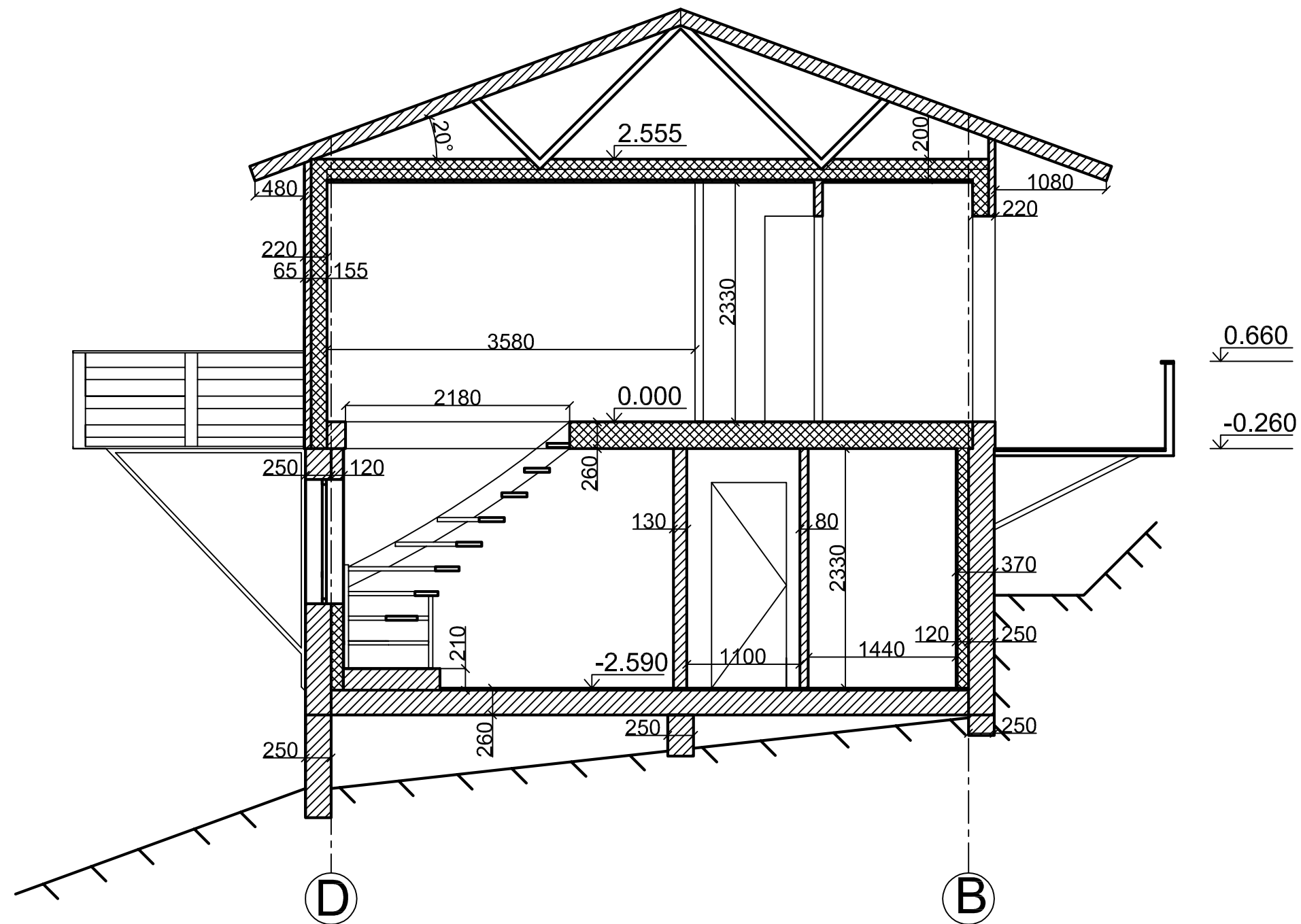
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Author		Ulvis Silins			First floor		Page	Scale

Basement floor 1:50

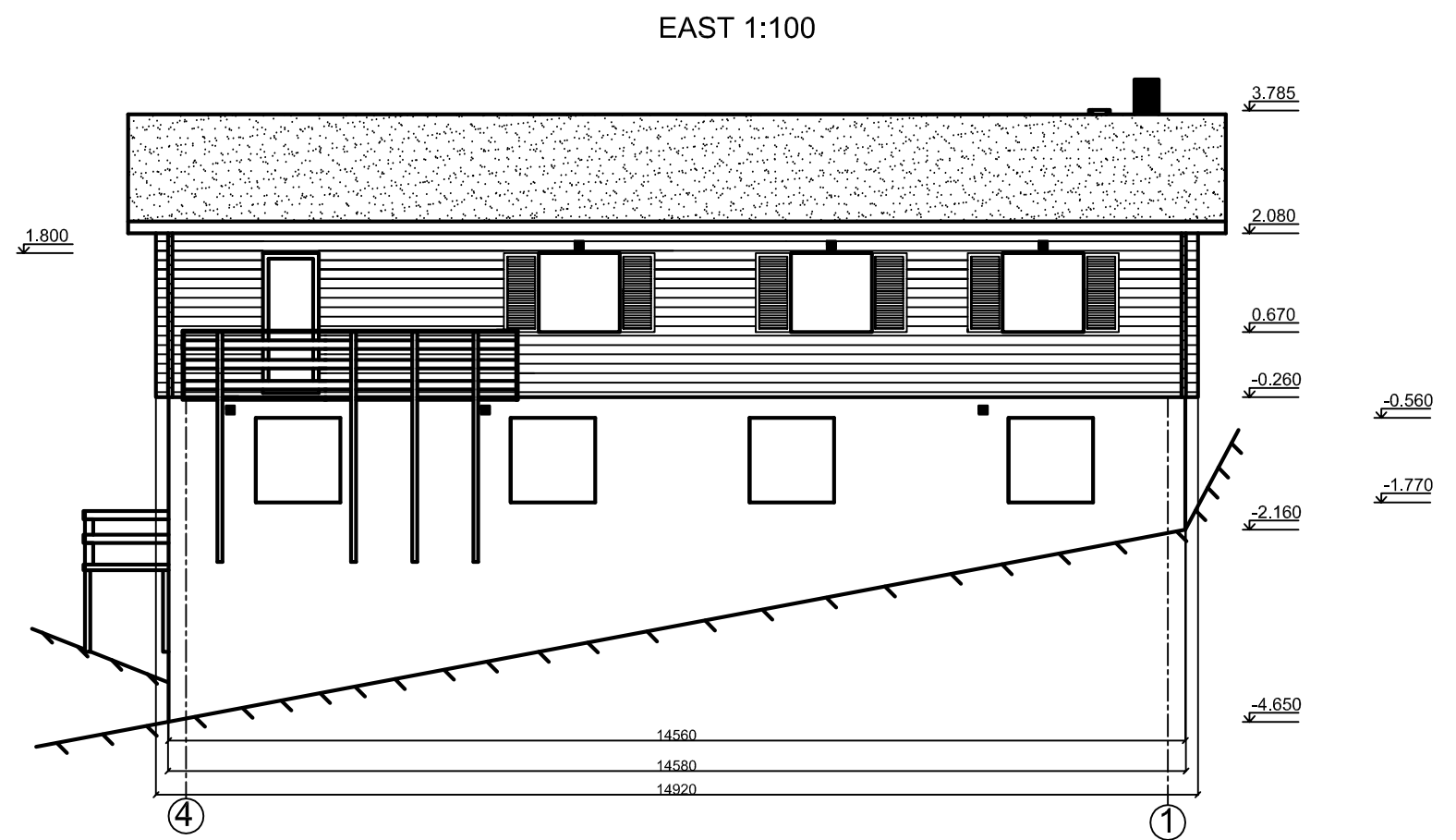
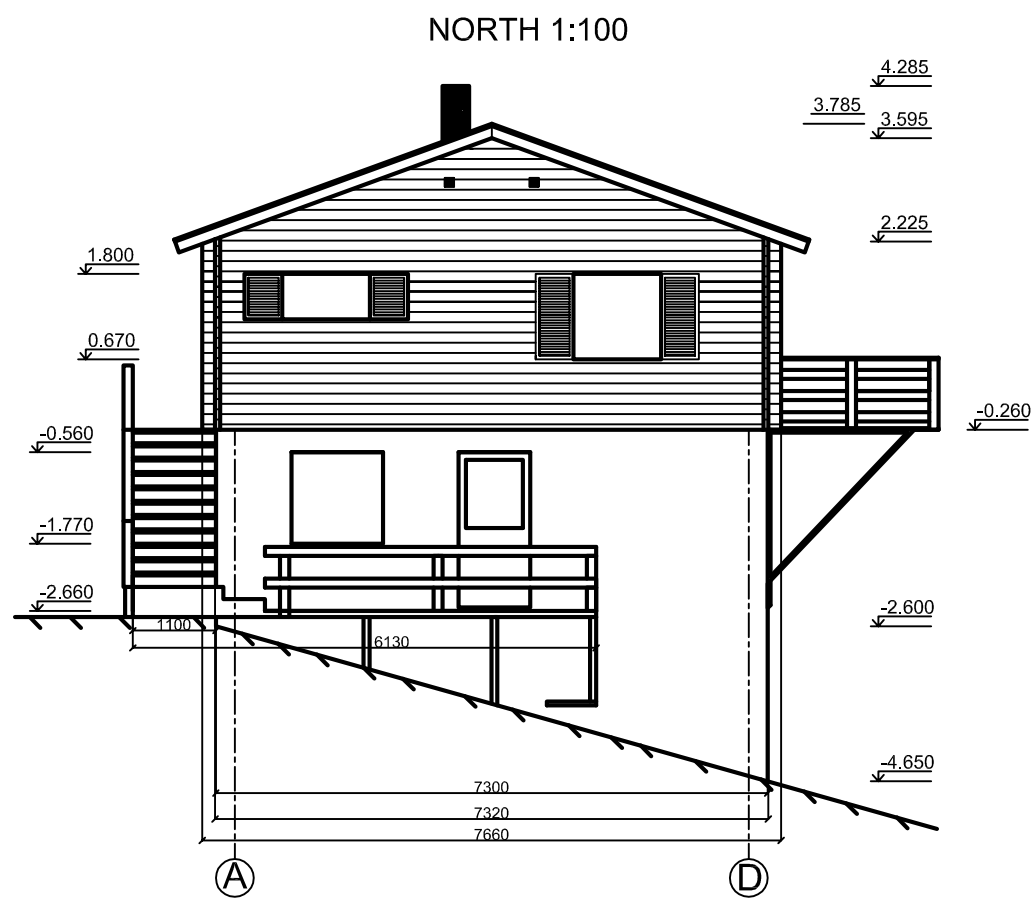
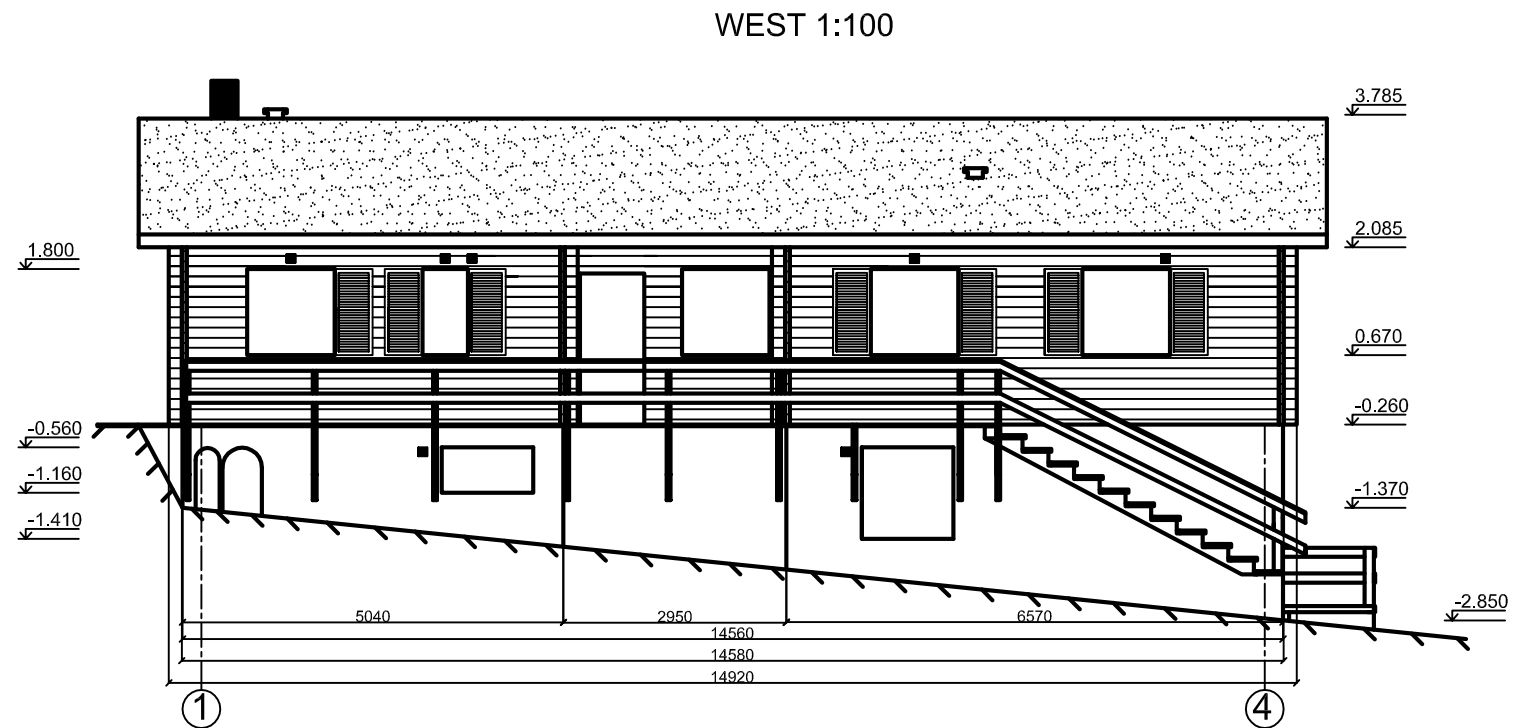
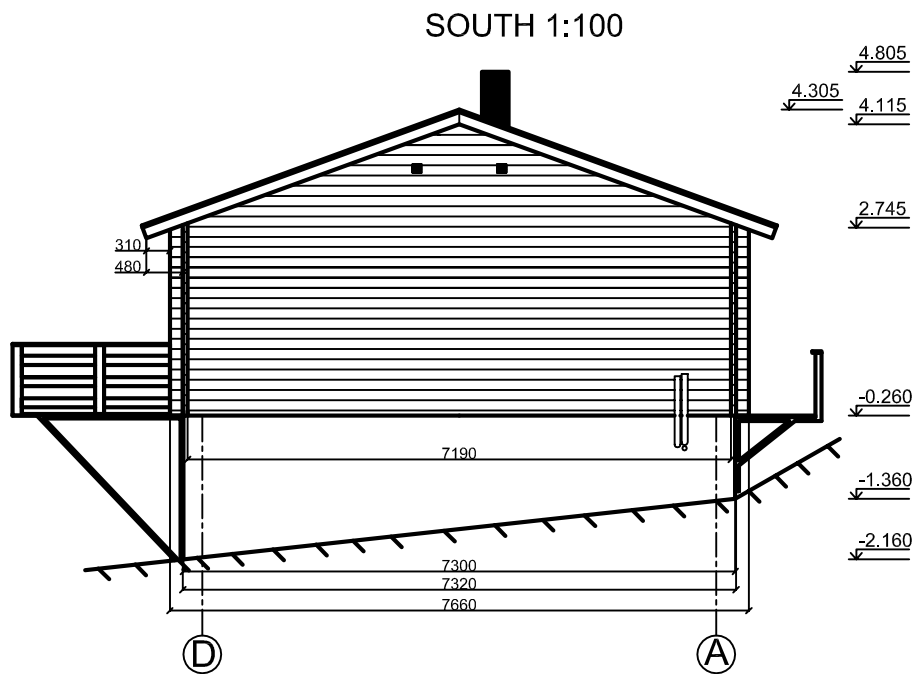


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Section "1-1" 1:50



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Author		Ulvis Silins						

Ilitsersuut / Instruktioer

-Akissutissat eqqortoq krydsiliiffiuk:

Sæt kryds i boksen udfor det ønskede svar:



Kukkuneq
Fejl

Eqqortoq
Korrekt svar

-Kukkuguit kukkusar titaruk taavalu eqqortoq krydsilerlugu:

I tilfælde af forkert afkrydsning, fyld boksen helt ud foran det forkerte svar, og sæt kryds ud for det ønskede svar:



-Allakkuit NAQINNERIT ANGISUUT atukkit.

Skriv venligst med BLOK BOGSTAVER.

-Nalunaarutigineqanngippat akissut ataasiinnaq toqqaruk.

Hvis ikke andet er opgivet, så vælg kun et svar.

-Pingaarutilimmik apequtissaqaruit attavigitigut.

Hvis du har spørgsmål, så tøv ikke med at kontakte os.

-Akissuteqarnikkut kukkussutissaqanngilatit, taamaallaat illit isummat naapertorlugu eqqorsorisat toqqaannassavat.

Der er ingen rigtige eller forkerte svar. Vælg det svar, som bedst repræsenterer din holdning.

Immikkoortoq 1 - Najukkap ilisarnaatai / Del 1 - Bolig karakteristika

Q1.1 Qanoq ittumi najugaqarpit? / Hvilken type bolig bor du i?

Illumi
Parcelhus



Illut uiguleriit
Dobbelthus



Illu uiguleriiaat
ilaat
Rækkehus



Inissiaq
Lejlighed



Alla
Andet



Q1.2 Najugat qassinik sinittarfeqarpa aammalu isersimaartarfeqarpa?

Hvor mange soveværelser og stuer findes der i din bolig?

1



2



3



4



5



>5



Q1.3 Najukkat qanga sananeqarpa? / Hvornår blev din bolig opført?

1960-i sioqqullugu
For år 1960



1960 - 1970



1970 - 1980



1980 - 1990



1990 - 2000



2000-ip kingorna
Efter år 2000



Naluara
Ved ikke



Q1.4 Najukkat kimit pigineqarpa? / Hvem ejer den bolig du bor i?

Uanga
Det gør jeg



Inuup allap
Anden privatperson



Kommune-p
Kommunen



Namminersorlutik
Oqartussat
Selvstyret



Alla
Andet



Naluara
Ved ikke



Immikkoortoq 2 - Najugallit / Del 2 - Beboere

Q2.1 Qanoq amerlatigisut najukkanni najugaqarpat (illit ilanngullutit):

Hvor mange personer bor der i din bolig (inklusive dig selv):

Arfineq marluk
sinnerlugit
Mere end 7

Inersimasut (18 - 60 ukiullit) / Voksne (18-60 år)

0



1



2



3



4



5



6



7



Meeqqat (3 - 18 ukiullit) / Born (3-18 år)



Meeraaqqat (0 - 3 ukiullit) / Spædborn (0 - 3 år)



Utoqqaat (60-it sinnerlugit ukiullit) / Ældre mennesker (Over 60 år)



Angutit qassit / Antal hankon?



Arnat qassit / Antal hunkon?



Q2.2

Illit najukkanni najugallit qassit illup iluani pujortartarpat?

Hvor mange beboere i din bolig, ryger indendørs i din bolig?

Arfineq marluk
sinnerlugit
Mere end 7

0	1	2	3	4	5	6	7	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Immikkoortoq 3 - Ileqqut / Del 3 - Vaner

Q3.1

Atortut taaneqartut qanoq akulikitsigisumik suliassanut taaneqartunut atatillugit atortapigit?

Hvor ofte bruger du følgende apparater, når du laver de følgende aktiviteter?

	Tamatigut Altid	Tamatigungajak Næsten altid	Ilaatigut Nogen gange	Qaqutigut Næsten aldrig	Atomeq ajorpara Aldrig	Atortorissaarut piginngilara Jeg har ikke dette apparat
Aalap milluaasua - Iganermi Emhætte - Under madlavning	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Igap matua - Iganermi Grydelåg - Under madlavning	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Uffarfimmi silaannamik milluaasoq (silaannarissaat) - Uffarnermi Udsugning fra badeværelse - Når du tager et bad	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Igalaaq ammasoq - Uffarnermi Åbner vinduet på badeværelset - Når du tager et bad	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Erruissut - Erruinnermi Opvaskemaskine - Når du vasker op	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q3.2

Piffissaq Ullormut qanoq annertutigisoq ukununga suliassanut atortarpiuk?

Hvor meget tid bruger du hver dag på de følgende aktiviteter?

180 minuttit
sinnerlugit
Mere end 180
minutter

	0 - 30 min.	30 - 60 min.	60 - 90 min.	90 - 120 min.	120 - 150 min.	150 - 180 min.	
Iganermut / Madlavning	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Iffiornermut / Bagning i ovnen	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q3.3

Qanoq ilillutit atisanik panersiinerusarpit - aasami ukiumilu ?

Hvordan tørrer du oftest dit vasketøj om sommeren og om vinteren?

	Silami Udenfor	Panersiivimmi I tørretumbleren	Najukkap iluani Ophæng i eget beboelsesrum	Ini panersiinnermut atugassiaq I et fælles tørrerum	Alla Andet
Aasakkut / Om sommeren	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ukiukkut / Om vinteren	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q3.4

Ukunani AASAKKUT sorliit qanoq akulikitsigisumik iliuuserisarpigit?

Hvor ofte gør du det følgende om SOMMEREN?

	Ullormut arlaleriarluni Flere gange om dagen	Ullormut ataasiarluni En gang om dagen	Sapaatip akunneranut arlaleriarluni Flere gange om ugen	Sapaatip akunnerani ataasiarlunga En gang om ugen	Qaammammut arlaleriarlunga Flere gange om måneden	Qaammammut ataasiarlunga ataalluguluunniit En gang om måneden eller mindre	Naluara Ved ikke
Igalaaq ammarlugu/matullugu Åbner / lukker vinduer	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kiappallaaraangat saagorluni/saaguerluni Trækker gardiner for/fra fordi det er for varmt.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Silaannarissaat ikillugu/qamillugu Tænder/slukker en bord- eller gulvventilator	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Errorsineq Vasker tøj	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Uffarnej	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q3.5

Ukunani UKIUKKUT sorliit qanoq akulikitsigisumik iliuuserisarpigit?

Hvor ofte gør du det følgende om **VINTEREN**?

	Ullormut arlaleriarluni Flere gange om dagen	Ullormut ataasiarluni En gang om dagen	Sapaatip akunneranut arlaleriarluni Flere gange om ugen	Sapaatip akunnerani ataasiarlunga En gang om ugen	Qaammammut arlaleriarlunga Flere gange om måneden	Qaammammut ataasiarlunga ataalluguluunniit En gang om måneden eller mindre	Naluara Ved ikke
Igalaaq ammarlugu/matullugu Åbner / lukker vinduer	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kiassaat inissillugu Justerer radiatoren	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Errorsineq Vasker tøj	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Uffarneq Tager et bad	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Immikkoortoq 4 - Illup iluata silaannaa aamma pissutsit

Del 4 - Indeklima og præferencer

Q4.1

Ukunani sorliit najukkanni misigisarpigit aammalu qanoq akulikitsigisumik?

Hvilket af det følgende oplever du i din bolig og hvor ofte?

	Akulikitsuaqqamik Meget ofte	Akulikitsumik Ofte	Akulikippallaanngitsumik Ikke så ofte	Qaatsikkut Næsten aldrig	Misigineq ajorpara Aldrig	Naluara Ved ikke
Oquk/aaneq Mug/svamp	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Sueq Koldt træk	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nateq nillertoq Koldt gulv	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nipiliorneq silamit sanilinilluunniit Støj udefra eller fra dine naboer	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aasaakkut kiappallaartoq For varmt om sommeren	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ukiukkut nillerpallaartoq For koldt om vinteren	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Najukkap iluani ulluklut qaamanikippallaartoq For lidt dagslys i boligen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Igalaat ukiuklut aalartut Kondensation på vinduer om vinteren.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peqqinnermut ajoqutit aatsaat angerlarsimagaagavit misigisartakkat (niaqorlunneq, kakkilertaneq, aneq panertoq, qasuneq allallu assingusut) Helbredsproblemer, du kun oplever når du er hjemme (hovedpine, næse der løber, tør hud, træthed, etc.)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Najukkanni allanik ajortoqarpat oqaatigerusutarnik taava uunga allakkitt

Hvis der er andre problemer i din bolig, som du gerne vil nævne, så benyt venligst dette felt.

Q4.2 Uku qanoq akulikitsigisumik eqqarsaatigisarpigit?

Hvor ofte tænker du på det følgende?

	Tamatigut Jeg tænker altid på det	Akulikitsuaqqamik Meget ofte	Akulikitsumik Ofte	Akulikipallaanngitsumik Ikke så ofte	Eqqarsaatigineq ajorpara Aldrig	Naluara Ved ikke
Qanoq akulikitsigisumik kiassarnermut akiligassat eqqarsaatigisarpigut illup iluata kiassusaa inissikkaagakkut Hvor ofte tænker du på varmeregningen, når du indstiller indendørstemperaturen?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Qanoq akulikitsigisumik kiassarnermut akiligassat eqqarsaatigisarpigut ukiukkut igalaat ammaraagakkut Hvor ofte tænker du på varmeregningen, når du åbner vinduerne om vinteren?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Qanoq akulikitsigisumik ilaqtutavit peqqissusaa eqqarsaatigisarpigut illup iluata kiassusaa inissikkaagakkut? Hvor ofte tænker du på dit/din families helbred, når du indstiller indendørstemperaturen?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Qanoq akulikitsigisumik ilaqtutavit peqqissusaa eqqarsaatigisarpigut ukiukkut igalaat ammaraagakkut? Hvor ofte tænker du på dit/din families helbred, når du åbner vinduerne om vinteren?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q4.3 Najukkanni uku qanoq misigisarpigit? / Hvordan oplever du de følgende forhold i din bolig?

	Ajungaatsiarpoq Meget dårligt	Ajorpoq Dårligt	Sullunarpoq Ringe	Ajorpiannigilaq Lidt godt	Ajunngilaq Godt	Ajunngitsorujussuuvoo Meget godt
Illu iluata kiassusaa / Termiske forhold / Indendørs temperatur	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Silaannap pitsaassusaa / Luftkvalitet	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nipinut tunngasut / Lydforhold	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Illup iluata silaannaa tamaat / Generelt indeklima	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q4.4 Takorlooruk UKIUUSOQ taavalu najukkat kiappallaarluni. Sussagaluarpit?

Forstil dig det er VINTER, og du har alt for varmt inde i den bolig? Hvad vil du gøre?

Igalaq ammarlugu Åbne vinduet	Kiassa at inissillugu Justere radiatoren	Nillertumik inerlutit Drikke noget koldt	Inissisimanerit allanngortillugu Skifte stilling	Atisat taarserlugit Skifte tøj	Inimut allamut nuullutit Går ind i et andet rum	Naluara Ved ikke
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q4.5 Takorlooruk UKIUUSOQ taavalu najukkat nillerpallaarluni. Sussagaluarpit?

Forstil dig det er VINTER, og du har det for koldt inde i din bolig? Hvad vil du gøre?

Kiassa at inissillugu Justere radiatoren	Kissartutorlutit Drikke noget varmt	Inissisimanerit allanngortillugu Skifte stilling	Atisat taarserlugit Skifte tøj	Inimut allamut nuullutit Går ind i et andet rum	Naluara Ved ikke
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q4.6 Uku qanoq ilinnut pingaaruteqartigippat najukkanni periafissaanissaat?

Hvor vigtigt er det for dig at have de følgende muligheder i din bolig?

	Pingaartorujussuuvoo Meget vigtigt	Pingaarpoo Vigtigt	Pingaarpallaanngilaq Mindre vigtigt	Pingaannigilaq Ikke vigtigt	Naluara Ved ikke
Igalaamik ammaasinnaaneq/matusisinnaaneq At have mulighed for at åbne/lukke vinduer	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Silaannaap aalernerata malugineqarsinnaanera At mærke luftbevægelsen indendørs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Silaannarissarsinnaaneq sueq isaatinnagu At kunne få frisk luft uden koldt træk	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Silaannarissarsinnaaneq nillertinnagu At kunne få frisk luft ind uden at det bliver for koldt	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Silaannarittuameq - silaannarisarfikkut At altid kunne få frisk luft fra ventilationsanlægget	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Silaannarissarsinnaaneq nipi isaatinnagu	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Immikkoortoq 5 - Aserfattaaliineq / Del 5 - Vedligeholdelse

Q5.1

Takorlooruk aningaasanik 200.000 kr-nik najukkannut iluarsartuussutissanik tunissutissillutit. Pisiassaq **ataaseq** toqqaruk aningaasanik atuiffiginiakkat.

Forestil dig at du får en donation på 200.000 DKK til at forbedre din bolig. Vælg venligst én ting, som du ville bruge pengene på.

Højtalerit nutaat
Nyt Hi-fi udstyr

☐

Igaffik nutaaq
Nyt køkken

☐

Isiginnaarut nutaaq
Nyt TV

☐

Uffarfik nutaaq
Nyt badeværelse

☐

Pequtit nutaat
Nye møbler

☐

Igalaat nutaat
Nye vinduer

☐

Silaannarissaat nutaaq
Nyt ventilationssystem

☐

Qaliaq nutaaq
Nyt tag

☐

Seqernup kissaanit nukiliuutit
Nye solpaneler

☐

Alla
Andet

☐

Q5.2

Qanoq ajornanngitsigiva paasiniassallugu qanoq teknikkikkut atortorissaarutit (silaannarissaatit, kissarsuut, kiassaatit) najukkanni atorineqarsinnaasut taavalu atorluarneqarsinnaanersut?

Hvor nemt er det at forstå hvordan de tekniske installationer (ventilation, fyr, radiator) fungerer i din bolig, og hvordan man kan udnytte dem bedst?

Nalunannitsorujussuuvoq
Meget nemt

☐

Nalunannigilaq
Nemt

☐

Nalunarpoq
Svært

☒

Nalunartorujussuuvoq
Meget svært

☐

Naluara
Ved ikke

☐

Q5.3

Isumaqarpit najukkanni atortorissaarutit (silaannarissaatit, kiassaatit allallu assingusut) atornissaanut siunnersuunneqartuuguvit ilitsersuunneqarlutillu iluaqutigissagit?

Tror du at du vil få gavn af at få råd og vejledning i at benytte de forskellige systemer (ventilation, opvarmning, etc.) i din bolig?

Aap
Ja

☒

Naamik
Nej

☐

Naluara
Ved ikke

☐

Q5.4

Qaammammut qanoq annertutigisumik innaallagissamut akiliisarpit?

Hvor meget betaler du hver måned for elektricitet?

250 kr-nit ataallugit
Mindre end 250 kr

☐

250 - 500
kr

☐

500 - 750
kr

☐

750 - 1000
kr

☐

1000 - 1250
kr

☒

1250 - 1500
kr

☐

1500 - 1750
kr

☐

1750 kr-nit
sinnerlugit
Mere end 1750 kr

☐

Naluara
Ved ikke

☐

Immikkoortoq 6 - Oqaaseqaatit / Del 6 - Kommentarer

Q6.1

Najukkannut allanut tunngasunik oqaaseqaatissaqaruit (arlaannik iluaagisaqaruit iluarisaqaruilluunniit), uunga allaguk:

Hvis du har yderligere kommentarer omkring din bolig (noget der er irriterende, eller som du værdsætter), så skriv det i det følgende felt:

+ God udsigt
+ Godt dagslys

- Huset har en opsamlingsbrønd til smelte/regnvand
- Har for få stikkontakter
- Gulvene knirker

Qujanaq immersugassaq immersorakku!

Immersuisimasut tunniussisimasullu tamarmik **3x 1000 kr-nik** makitsinermut peqataatinneqassapput.

Tak fordi du udfyldte dette skema!

Der vil blive udtrukket 3x1000 DKK i præmie imellem alle deltagere som udfylder og afleverer skemaet.

Eqquissagaluaruit attavigissagutsigit, minnerpaamik ukunani ataaseq immersoruk:

For at kunne kontakte dig, i tilfælde af at du vinder, udfyld mindst et af de følgende felter:

MALUGIUK: *Paasissutissat allanut ATORNEQARNAVIANNGILLAT.*

BEMÆRK: *Disse data vil IKKE blive brugt til andre formål.*

Najugaqarfik / Adresse

Qajaasat 19
39 u sisimiut

Oqarasuaatip normua / Telefonnummer

+299 522507

E-mail

axol@qeqqata.gl

Misissuinerup tullissaanut peqataarusuppit? Tassani najugaqartut 80-it toqqarneqariarlutik ukiumi sapaatip akunnera ataaseq aasamilu sapaatip akunnera ataaseq najukkami uuttortaanermut peqataatinneqassapput.

Kunne du eventuelt tænke dig at deltage i en opfølgning på dette forskningsprojekt, hvor ca. 80 boliger vil blive udvalgt til at få udført indeklimate målinger i en uge om sommeren, og en uge om vinteren.

Misissuinerup tullinnguuttumut peqataasut misissuinerup inernerit **AKEQANNGITSUMIK** pissavaat. Taakkunani pineqarput illup silaannaata pitsaassusaa taavalu qanoq pitsaanerulersinnaanera, innaallagissamik atuineq annikillineqarsinnaaneralu kiisalu illup kiaffiisa nalunaarsornerat (Termografiske billeder).

Deltagerne i denne opfølgning, vil modtage en individuel rapport for deres bolig, med luftkvalitetsevaluering, energieuvaluering og termografiske billeder GRATIS!

Peqataaqqittunut 3x 1000 kr-nik makitsisoqaqqissaaq.

Der vil også blive udtrukket 3x1000 DKK iblandt deltagende boliger i denne opfølgning

Aap, peqataarusuppunga aammalu najugaqarfiga paasisaqarfigerusuppaa.
Ja, jeg vil gerne deltage og få et bedre overblik over min bolig.



Naamik, peqataarusunngilanga.
Nej, jeg vil ikke deltage.



Malugiuk: *Apeqummut kingullermut AAPPEERSIMAGUIT, eqqaamajuk*

attaviginninneqarnissamut paasissutissat ilanngunnissai, paasissutissanik tuneqqinniassagatsigit.

Bemærk: Hvis dit svar til det sidste spørgsmål er JA (hvilket vi sætter pris på!), så husk venligst at opgive dine kontaktoplysninger, så vi kan informere dig yderligere om opfølgningen.

ANNEX F – BLOWER-DOOR TEST

1 Depressurization (sealed, “Method B”)

Building Details

Building Address: Qajasat 19, B-1158,
Sisimiut, Greenland

Test technician: **Ulvis Silins**
Test company: **DTU**

Elevation: **37 m**
Height above ground: **7.5 m**
Building Volume, V: **453.9 m³**
Total envelope area, $A_{T\text{ BAT}}$ **382 m²**
Floor Area: **183.8 m²**
Building exposure to wind:
Accuracy of measurements: **100%**

Testing Details

Fan Model: Retrotec 2000	Fan SN:	Gauge Model: DM-2	Gauge SN: 202276
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Depressurize set

Date: **2011-08-08** Time: **15:27** to **15:45**

Environmental Conditions:

Barometric Pressure: **100.9** KPa from **Elevation. 37**

Wind speed: **3: Gentle breeze**

Temperature: Initial: indoors **23 °C** outdoors **14 °C**.
Final: indoors **23 °C** outdoors **14 °C**.

Test Data:

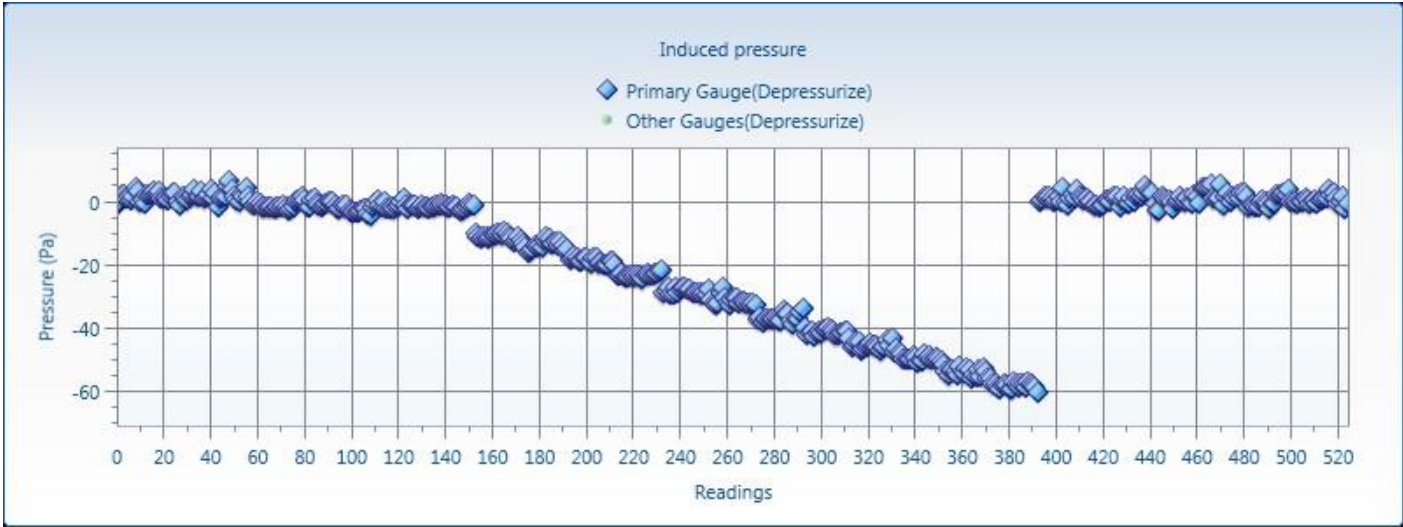
12 Baseline pressures taken for **10** sec each.

12 building pressures taken for **20** sec each.

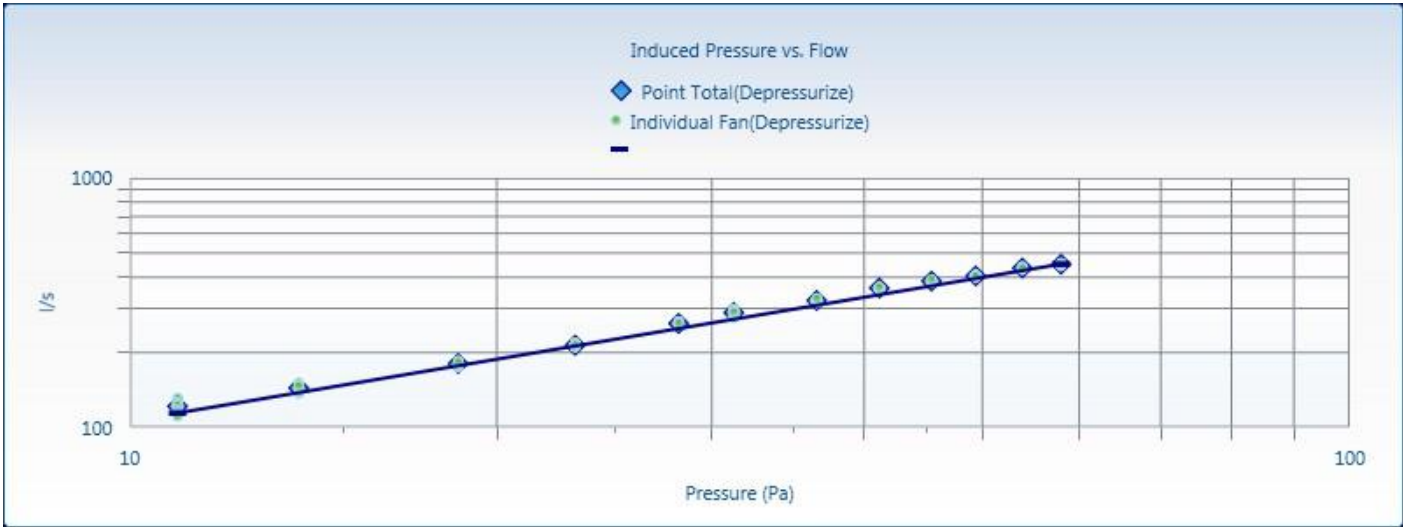
Baseline, initial [Pa]	1.29	2.24	1.48	2.52	0.59	-1.81	-0.09	-1.29	-2.22	-1.19	-1.42	-1.62
Building Test Pressure [Pa]	-10.9	-13.8	-18.6	-23.2	-28.2	-31.3	-36.6	-41.2	-45.4	-49.4	-53.9	-58.0
Baseline, final [Pa]	1.14	1.12	-0.13	0.78	1.33	0.21	2.68	1.93	-0.71	1.29	0.24	1.02
Door Fan Pressure, [Pa]	17.8	24.7	38.4	53.4	78.9	95.8	119.2	148.5	168	184.3	212	226.6
Total flow, V_T [l/sec]	121.8	144.1	180.7	213.9	261.5	288.8	323.2	362.2	386.0	405.0	435.6	450.9
Corrected flow, V_{env} [l/sec]	118.9	140.7	176.4	208.8	255.2	281.9	315.5	353.5	376.8	395.3	425.2	440.1
Error [%]	1.0%	-0.5%	-2.0%	-3.0%	1.2%	2.7%	1.2%	3.0%	1.3%	-0.7%	-0.7%	-3.1%

Baseline pressure Averages: initial [Pa] ΔP_{01} **-0.13**, ΔP_{01-} **-1.38**, ΔP_{01+} **1.62**
final [Pa] ΔP_{01} **0.91**, ΔP_{01-} **-0.42**, ΔP_{01+} **1.17**

Building Gauge Pressure



Building Gauge Pressure vs. Flow



Depressurize Test Results

	Results				Results	95% confidence		Uncertainty
Correlation, r [%]	99.89	95% confidence limits		Air flow at 50 Pa, V_{50} [l/s]	401.0	393.5	409.0	+/-0.0190
Intercept, C_{env} [l/s.Pa ⁿ]	15.95	14.55	17.50	Air changes at 50 Pa, n_{50} [/h]	3.180	0.002590	6.361	+/-0.9992
Intercept, C_L [l/s.Pa ⁿ]	16.01	14.60	17.60	Permeability at 50 Pa, q_{50} [l/s.m ²]	1.050	0.001	2.100	
Slope, n	0.8234	0.7965	0.8503	Specific Leakage at 50 Pa, w_{50} [l/s.m ²]	2.183	0.002	4.365	+/-0.9992

Combined Test Data	Results	95% Confidence Interval		Uncertainty
Air flow at 50 Pa, V_{50} [l/s]	401.0	393.5	409.0	+/-0.0190
Air changes at 50Pa, n_{50} [/h]	3.180	0.002590	6.361	+/-0.9992
Permeability at 50 Pa, q_{50} [l/s.m ²]	1.050	0.001	2.100	+/-1.0000
Specific leakage at 50 Pa, w_{50} [l/s.m ²]	2.183	0.002	4.365	+/-0.0190

Test Notes:(add notes here)

Calibration Certificate

Retrotec 2000 .						
Range	N	K	K1	K2	K3	K4
Open(22)	0.5214	486.99	-0.07	0.8	-0.115	1.067
A	0.503	259.038	-0.075	1	0	1.023
B	0.5	174.8824	0	0.3	0	1
C8	0.5	78.5	-0.02	0.5	0.016	1
C6	0.505	61.3	0.054	0.5	0.004	1
C4	0.514	39.3	0.08	0.5	0.0005	1
C2	0.55	20	0.139	0.5	-0.0027	1
C1	0.541	11.9239	0.122	0.4	0	1
L4	0.48	4.0995	0.003	1	0.0004	1
L2	0.502	2.0678	0	0.5	0.0001	1
L1	0.4925	1.1614	0.1	0.5	0.0001	1

2 Pressurization (sealed, “Method B”)

Testing Details

Fan Model: Retrotec 2000	Fan SN:	Gauge Model: DM-2	Gauge SN: 202276
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Pressurize set

Date: **2011-08-08** Time: **16:40** to **16:57**

Environmental Conditions:

*Barometric Pressure:***100.9** KPa from **Elevation.37**

Wind speed: **3: Gentle breeze**

Temperature: Initial: indoors **23 °C** outdoors **14 °C**.
Final: indoors **23 °C** outdoors **14 °C**.

Test Data:

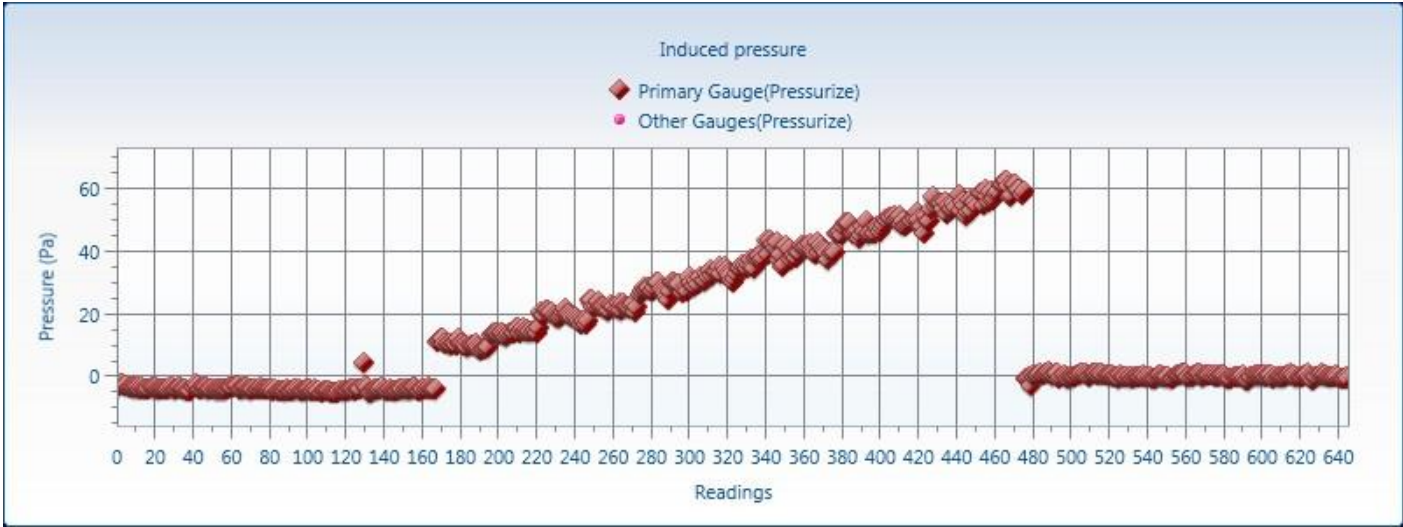
12 Baseline pressures taken for **10** sec each.

12 building pressures taken for **20** sec each.

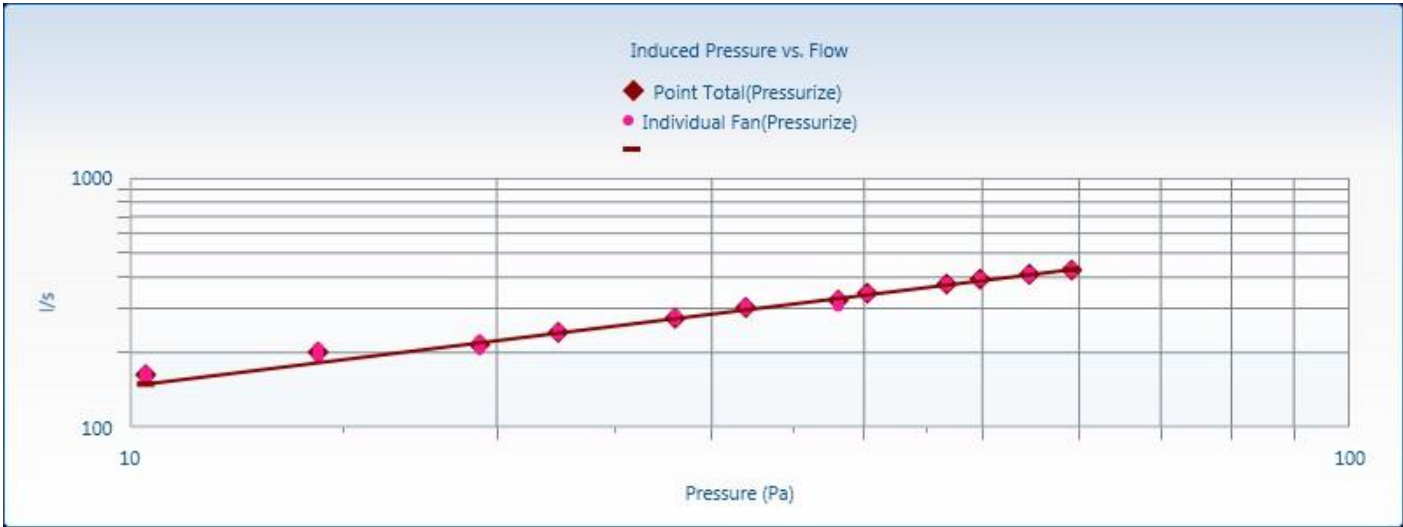
Baseline, initial [Pa]	-3.11	-3.72	-3.68	-3.74	-3.52	-3.87	-4.24	-4.37	-4.41	-3.38	-4.18	-3.85
Building Test Pressure [Pa]	10.3	14.3	19.4	22.5	28.0	32.0	38.1	40.2	46.7	49.8	54.6	59.2
Baseline, final [Pa]	0.31	0.20	0.84	0.04	0.02	0.24	0.53	0.10	0.00	0.22	0.18	0.01
Door Fan Pressure, [Pa]	41.4	61.1	73.1	89.6	114.5	136.8	157.7	176	206.5	224.3	244.8	264.4
Total flow, V_r [l/sec]	162.9	200.7	214.9	240.8	274.2	302.7	323.7	345.7	375.9	393.6	411.3	427.9
Corrected flow, V_{env} [l/sec]	166.4	205.0	219.5	246.0	280.1	309.2	330.6	353.1	383.9	402.0	420.1	437.0
Error [%]	0.8%	4.8%	-5.0%	-1.9%	-1.3%	1.0%	-2.3%	1.1%	0.8%	1.7%	0.7%	0.0%

Baseline pressure Averages: initial [Pa] ΔP_{01} **-3.84**, ΔP_{01-} **-3.84**, ΔP_{01+} **0.00**
final [Pa] ΔP_{01} **0.22**, ΔP_{01-} **0.00**, ΔP_{01+} **0.25**

Building Gauge Pressure



Building Gauge Pressure vs. Flow



Pressurize Test Results

	Results				Results	95% confidence		Uncertainty
<i>Correlation, r [%]</i>	99.70	95% confidence limits		<i>Air flow at 50 Pa, V_{50} [l/s]</i>	386.0	377.5	394.5	+/-0.0217
<i>Intercept, C_{env} [l/s.Paⁿ]</i>	36.55	32.50	41.05	<i>Air changes at 50 Pa, n_{50} [/h]</i>	3.061	0.002300	6.120	+/-0.9993
<i>Intercept, C_L [l/s.Paⁿ]</i>	36.35	32.35	40.90	<i>Permeability at 50 Pa, q_{50} [l/s.m²]</i>	1.010	0.001	2.020	
<i>Slope, n</i>	0.6038	0.5705	0.6371	<i>Specific Leakage at 50 Pa, w_{50} [l/s.m²]</i>	2.100	0.002	4.198	+/-0.9992

Combined Test Data

	Results	95% Confidence Interval		Uncertainty
<i>Air flow at 50 Pa, V_{50} [l/s]</i>	386.0	377.5	394.5	+/-0.0217
<i>Air changes at 50Pa, n_{50} [/h]</i>	3.061	0.002300	6.120	+/-0.9993
<i>Permeability at 50 Pa, q_{50} [l/s.m²]</i>	1.010	0.001	2.020	+/-1.0000
<i>Specific leakage at 50 Pa, w_{50} [l/s.m²]</i>	2.100	0.002	4.198	+/-0.0220

Test Notes:(add notes here)

Calibration Certificate

Retrotec 2000 .						
Range	N	K	K1	K2	K3	K4
Open(22)	0.5214	486.99	-0.07	0.8	-0.115	1.067
A	0.503	259.038	-0.075	1	0	1.023
B	0.5	174.8824	0	0.3	0	1
C8	0.5	78.5	-0.02	0.5	0.016	1
C6	0.505	61.3	0.054	0.5	0.004	1
C4	0.514	39.3	0.08	0.5	0.0005	1
C2	0.55	20	0.139	0.5	-0.0027	1
C1	0.541	11.9239	0.122	0.4	0	1
L4	0.48	4.0995	0.003	1	0.0004	1
L2	0.502	2.0678	0	0.5	0.0001	1
L1	0.4925	1.1614	0.1	0.5	0.0001	1

3 Depressurization (unsealed, “Method A”)

Testing Details

Fan Model: Retrotec 2000	Fan SN:	Gauge Model: DM-2	Gauge SN: 202276
-------------------------------------	---------	--------------------------	-------------------------

Depressurize set

Date: **2011-08-08** Time: **17:36** to **17:54**

Environmental Conditions:

*Barometric Pressure:***100.9** KPa from **Elevation.37**

Wind speed: **3: Gentle breeze**

Temperature: Initial: indoors **23 °C** outdoors **14 °C**.
Final: indoors **23 °C** outdoors **14 °C**.

Test Data:

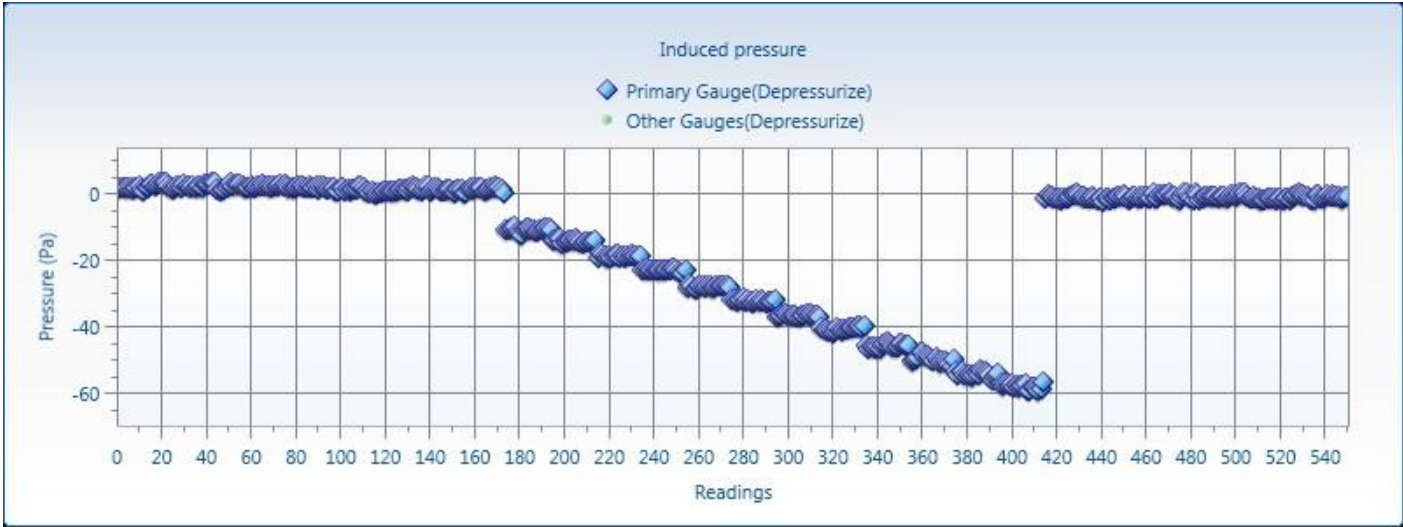
12 Baseline pressures taken for **10** sec each.

12 building pressures taken for **20** sec each.

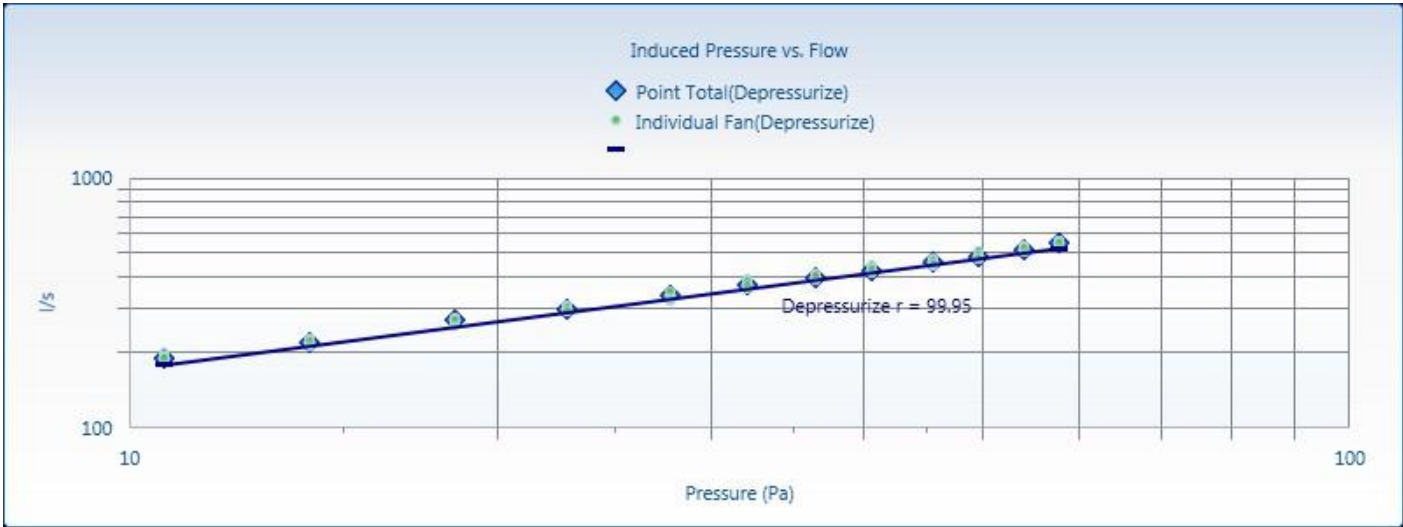
Baseline, initial [Pa]	1.85	2.72	2.75	2.24	2.52	2.31	1.73	1.19	1.28	1.63	1.27	1.78
Building Test Pressure [Pa]	-10.7	-14.0	-18.5	-22.8	-27.7	-32.0	-36.5	-40.5	-45.6	-49.7	-54.1	-57.7
Baseline, final [Pa]	-0.90	-0.68	-1.04	-0.84	-0.33	-0.63	-0.80	-0.33	-1.24	-0.98	-0.74	-0.65
Door Fan Pressure, [Pa]	26	34.5	51	62.9	79.6	98.5	111.3	125.7	145.3	159.8	180.4	200.1
Total flow, V_r [l/sec]	190.6	220.1	268.2	298.7	337.0	376.2	400.9	427.4	461.2	485.0	517.4	547.0
Corrected flow, V_{env} [l/sec]	186.1	214.9	261.8	291.6	329.0	367.2	391.4	417.2	450.2	473.4	505.0	533.9
Error [%]	0.8%	-1.3%	1.5%	-0.7%	-0.8%	1.2%	-0.5%	-0.7%	-0.5%	-0.9%	0.2%	1.7%

Baseline pressure Averages: initial [Pa] ΔP_{o1} **1.94**, ΔP_{o1-} 0.00, ΔP_{o1+} **1.94**
final [Pa] ΔP_{o1} **-0.76**, ΔP_{o1-} **-0.76**, ΔP_{o1+} **0.00**

Building Gauge Pressure



Building Gauge Pressure vs. Flow



Depressurize Test Results

	Results				Results	95% confidence		Uncertainty
<i>Correlation, r [%]</i>	99.95	95% confidence limits		<i>Air flow at 50 Pa, V_{50} [l/s]</i>	479.0	474.5	484.0	+/-0.0097
<i>Intercept, C_{env} [l/s.Paⁿ]</i>	39.50	37.65	41.45	<i>Air changes at 50 Pa, n_{50} [/h]</i>	3.800	0.003600	7.595	+/-0.9990
<i>Intercept, C_L [l/s.Paⁿ]</i>	39.75	37.90	41.70	<i>Permeability at 50 Pa, q_{50} [l/s.m²]</i>	1.254	0.001	2.507	
<i>Slope, n</i>	0.6363	0.6224	0.6502	<i>Specific Leakage at 50 Pa, w_{50} [l/s.m²]</i>	2.607	0.002	5.212	+/-0.9990

Combined Test Data

	Results	95% Confidence Interval		Uncertainty
<i>Air flow at 50 Pa, V_{50} [l/s]</i>	479.0	474.5	484.0	+/-0.0097
<i>Air changes at 50Pa, n_{50} [/h]</i>	3.800	0.003600	7.595	+/-0.9990
<i>Permeability at 50 Pa, q_{50} [l/s.m²]</i>	1.254	0.001	2.507	+/-1.0000
<i>Specific leakage at 50 Pa, w_{50} [l/s.m²]</i>	2.607	0.002	5.212	+/-0.0100

Test Notes:(add notes here)

Calibration Certificate

Retrotec 2000 .						
Range	N	K	K1	K2	K3	K4
Open(22)	0.5214	486.99	-0.07	0.8	-0.115	1.067
A	0.503	259.038	-0.075	1	0	1.023
B	0.5	174.8824	0	0.3	0	1
C8	0.5	78.5	-0.02	0.5	0.016	1
C6	0.505	61.3	0.054	0.5	0.004	1
C4	0.514	39.3	0.08	0.5	0.0005	1
C2	0.55	20	0.139	0.5	-0.0027	1
C1	0.541	11.9239	0.122	0.4	0	1
L4	0.48	4.0995	0.003	1	0.0004	1
L2	0.502	2.0678	0	0.5	0.0001	1
L1	0.4925	1.1614	0.1	0.5	0.0001	1

4 Pressurization (unsealed, “Method A”)

Testing Details

Fan Model: Retrotec 2000	Fan SN:	Gauge Model: DM-2	Gauge SN: 202276
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Pressurize set

Date: **2011-08-08** Time: **17:10** to **16:57**

Environmental Conditions:

*Barometric Pressure:***100.9** KPa from **Elevation.** 37

Wind speed: **3: Gentle breeze**

Temperature: Initial: indoors **23 °C** outdoors **14 °C**.
Final: indoors **23 °C** outdoors **14 °C**.

Test Data:

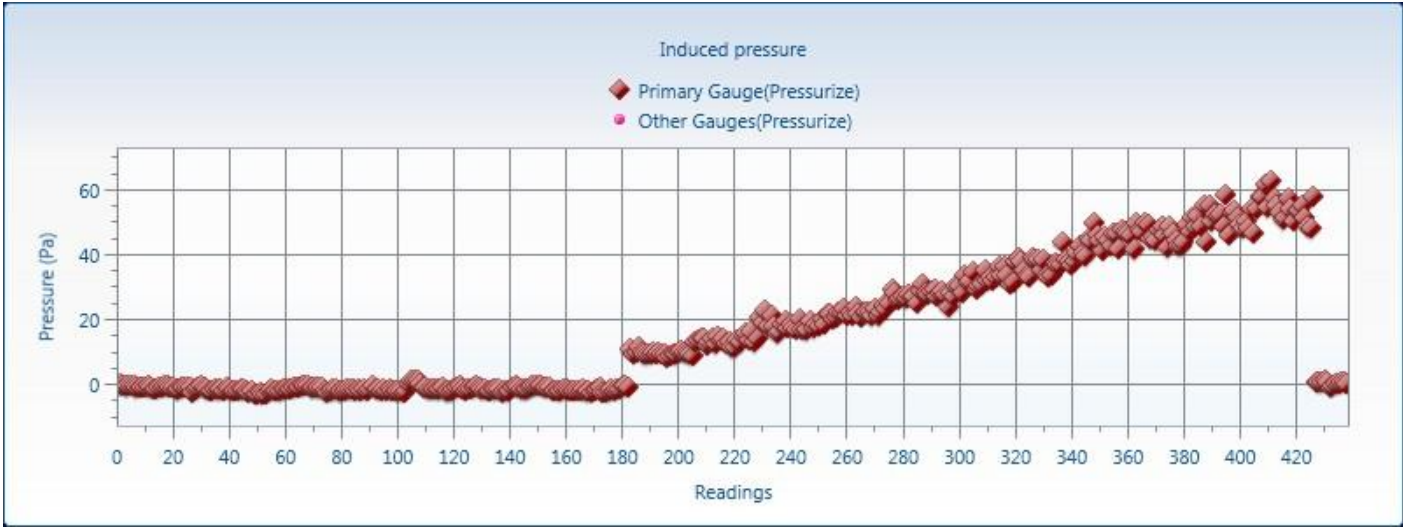
12Baseline pressures taken for **10** sec each.

12 building pressures taken for **20** sec each.

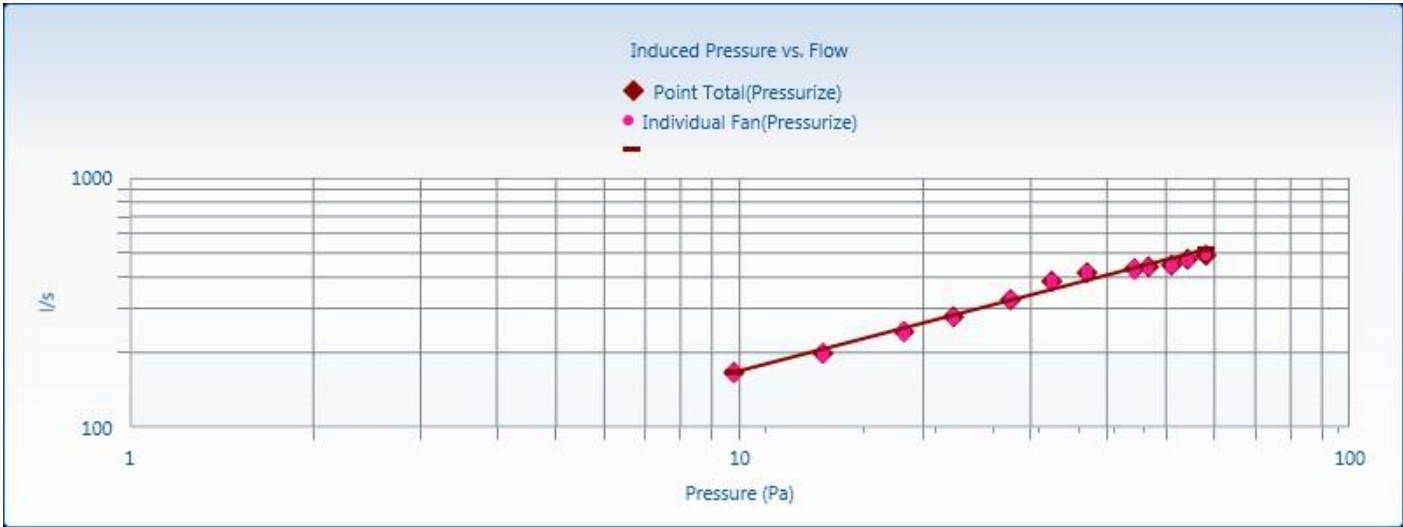
Baseline, initial [Pa]	-0.56	-0.91	-1.44	-2.01	-1.00	-1.50	-1.00	-1.15	-1.31	-0.96	-1.59	-1.45
Building Test Pressure [Pa]	9.8	13.7	18.6	22.4	27.8	32.5	37.1	44.4	46.8	51.0	54.2	58.1
Baseline, final[Pa]	1.02	0.75	0.63	1.12	0.70	-0.52	-0.38	0.12	0.37	0.59	0.96	0.49
Door Fan Pressure, [Pa]	42.2	59.5	86.2	111	148	199.2	231.6	253.7	263.4	273.9	301.6	323.3
Total flow, V_r [l/sec]	166.4	198.4	242.2	278.1	325.3	385.4	417.3	433.1	440.9	447.4	472.5	489.9
Corrected flow, V_{env} [l/sec]	170.0	202.7	247.4	284.0	332.3	393.6	426.2	442.4	450.3	456.9	482.5	500.4
Error [%]	-0.4%	-3.5%	-2.6%	-0.5%	1.7%	9.2%	8.8%	0.8%	-0.7%	-4.6%	-3.1%	-3.8%

Baseline pressure Averages: initial [Pa] ΔP_{01} **-1.24**, ΔP_{01-} **-1.24**, ΔP_{01+} **0.00**
final [Pa] ΔP_{01} **0.49**, ΔP_{01-} **-0.45**, ΔP_{01+} **0.68**

Building Gauge Pressure



Building Gauge Pressure vs. Flow



Pressurize Test Results

	Results				Results	95% confidence		Uncertainty
Correlation, r [%]	99.24	95% confidence limits		Air flow at 50 Pa, V_{50} [l/s]	469.0	450.5	488.0	+/-0.0404
Intercept, C_{env} [l/s.Pa ⁿ]	38.95	32.15	47.25	Air changes at 50 Pa, n_{50} [/h]	3.720	0.0007	7.435	+/-0.9998
Intercept, C_L [l/s.Pa ⁿ]	38.70	32.00	47.05	Permeability at 50 Pa, q_{50} [l/s.m ²]	1.227	0.000	2.455	
Slope, n	0.6370	0.5815	0.6925	Specific Leakage at 50 Pa, w_{50} [l/s.m ²]	2.552	0.000	5.103	+/-0.9998

Combined Test Data

	Results	95% Confidence Interval		Uncertainty
Air flow at 50 Pa, V_{50} [l/s]	469.0	450.5	488.0	+/-0.0404
Air changes at 50Pa, n_{50} [/h]	3.720	0.0007	7.435	+/-0.9998
Permeability at 50 Pa, q_{50} [l/s.m ²]	1.227	0.000	2.455	+/-1.0000
Specific leakage at 50 Pa, w_{50} [l/s.m ²]	2.552	0.000	5.103	+/-0.0400

Test Notes:(add notes here)

Calibration Certificate

Retrotec 2000 .						
Range	N	K	K1	K2	K3	K4
Open(22)	0.5214	486.99	-0.07	0.8	-0.115	1.067
A	0.503	259.038	-0.075	1	0	1.023
B	0.5	174.8824	0	0.3	0	1
C8	0.5	78.5	-0.02	0.5	0.016	1
C6	0.505	61.3	0.054	0.5	0.004	1
C4	0.514	39.3	0.08	0.5	0.0005	1
C2	0.55	20	0.139	0.5	-0.0027	1
C1	0.541	11.9239	0.122	0.4	0	1
L4	0.48	4.0995	0.003	1	0.0004	1
L2	0.502	2.0678	0	0.5	0.0001	1
L1	0.4925	1.1614	0.1	0.5	0.0001	1

BOOKS 9
3911 Sisimiut
Tlf .: (00 299) 864020
Fax .: (00 299) 864775

Kontoret har åbent:
hverdage kl. 8:00 - 16:00
lørdag og søndag lukket
E-mail .: Sisolie@greenet.gl

AXEL LUND OLSEN

Faktura 811973

QAJAASAT 19 B-1158
3911 SISIMIUT

Kundenr.: 014146
Dato: 16/03-11
Forfaldsdato: 24/03-11
Side: 2

Varenr	Varebetegnelse	Antal	Enh	Pris	Beløb
2009	Solar - Arctic Grade	695	Ltr	4,47	3.106,65
1200	Kørsel fast pris 1200 L	1	Ltr	140,00	140,00

Aqq/Rb

39395

BETALT

19 MAJ 2011

SISIMIUT OLIE APS

Val
DKK

Totalbeløb
3.246,65

4,535

Axel

axol@geggata.gl

mobil: + 522507

Olje ApS

Apq. 1

AS 9

1 Sisimiut

Tlf .: (00 299) 864020

Fax .: (00 299) 864775

Kontoret har åbent:

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lørdag og søndag lukket

E-mail .: Sisolie@greenet.gl

AXEL LUND OLSEN

Faktura 810512

QAJAASAT 19 B-1158

3911 SISIMIUT

Kundenr.: 014146

Dato: 27/01-11

Forfaldsdato: 04/02-11

Side: 2

Varenr	Varebetegnelse	Antal	Enh	Pris	Beløb
2009	Solar Arctic Grade	668	Ltr	4,47	2.985,96
1200	Kørsel fast pris 1200 L	1	Ltr	140,00	140,00

As/Gs

38839

BETALT

9 FEB. 2011

SISIMIUT OLIE APS

Val
DKK

Totalbeløb
3.125,96

Sisimiut Olie ApS

Kaassassuup aqq. 1

Postboks 9

3911 Sisimiut

Tlf .: (00 299) 864020

Fax .: (00 299) 864775

Kontoret har åbent:

hverdage kl. 8:00 - 16:00

lørdag og søndag lukket

E-mail .: Sisolie@greennet.gl

AXEL LUND OLSEN

QAJAASAT 19 B-1158

3911 SISIMIUT

Faktura 803737

Kundenr.: 014146

Dato: 30/11-10

Forfaldsdato: 08/12-10

Side: 2

Varenr	Varebetegnelse	Antal Enh	Pris	Beløb
2009	Solar - Arctic Grade	601 Ltr	4,27	2.566,27
1200	Kørsel fast pris	1 Ltr	140,00	140,00
	1200 L			

gs/jk

38158

BETALT
23/12/2010

Val
DKK

Totalbeløb
2.706,27

Sisimiut Olie ApS

Kaassassuup aqq. 1
Postboks 9
3911 Sisimiut
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Fax .: (00 299) 864775

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hverdage kl. 8:00 - 16:00
lørdag og søndag lukket
E-mail .: Sisolie@greenet.gl

AXEL LUND OLSEN

Fakturakopi 802183

QAJAASAT 19 B-1158
3911 SISIMIUT

Kundenr.: 014146
Dato: 28/09-10
Forfaldsdato: 06/10-10
Side: 2

Varenr	Varebetegnelse	Antal	Enh	Pris	Beløb
2009	Solar - Arctic Grade	518	Ltr	4,27	2.211,86
1200	Kørsel fast pris 1200 L	1	Ltr	140,00	140,00

Aqq/Jk

37499

BETALT

25 OKT. 2010

Sisimiut Olie ApS

Val	Totalbeløb
DKK	2.351,86

Sisimiut Olie ApS

Kaassassuup aqq. 1
Postboks 9
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E-mail .: Sisolie@greenet.gl

AXEL LUND OLSEN

QAJAASAT 19 B-1158
3911 SISIMIUT

Faktura 2956

Kundenr.: 014146
Dato: 27/05-10
Forfaldsdato: 04/06-10
Side: 2

Varenr	Varebetegnelse	Antal	Enh	Pris	Beløb
2009	Solar - Arctic Grade	423	Ltr	4,27	1.806,21
1200	Kørsel fast pris 1200 L	1	Ltr	140,00	140,00

aqq/jk

BETALT

3-0 JUNI 2010

SISIMIUT OLIE APS

Val
DKK

Totalbeløb
1.946,21

Sisimiut Olie ApS

Kaassassuup aqq. 1

Postboks 9

3911 Sisimiut

Tlf .: (00 299) 864020

Fax .: (00 299) 864775

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lørdag og søndag lukket

E-mail .: Sisolie@greenet.gl

AXEL LUND OLSEN

Faktura 1379

QAJAASAT 19 B-1158

3911 SISIMIUT

Kundenr.: 014146

Dato: 26/03-10

Forfaldsdato: 03/04-10

Side: 1

Varenr	Varebetegnelse	Antal	Enh	Pris	Beløb
2009	Solar - Arctic Grade	798	Ltr	4,27	3.407,46
1200	Kørsel fast pris 1200 L	1	Ltr	140,00	140,00

aqq/jk

BETALT

29 APR. 2010

~~SISIMIUT~~ OLIE APS

Val
DKK

Totalbeløb
3.547,46

Sisimiut Olie Aps

Kaassassuup aqq. 1
Postboks 9
Tlf: +299 86 40 20
Fax: +299 86 47 75
e-mail: sisolie@greenet.gl

Kontoret har å
hverdage kl.8:
lørdag og søn

Sisimiut Olie APS
Postboks 9
3911 Sisimiut
TLF. 299866136
CUR.NR. 21366633

AXEL LUND OLSEN

QAJAASAT 19 B-1158

3911 SISIMIUT

Varenr. Betegnelse

Følgeseddelsnr. 34369 AS/GS

2009	Solar - Arctic Grade	Ltr.	670,00	4,27	2.860,90
1200	Kørsel fast pris under 800 L	Ltr.	1,00	140,00	140,00

Automatisk opfyldning

Næste opfyldning : 26-03-10

2010-02-26 15:49

KØB DKK 3000,90

VisaDankort PSN: 00

XXXX XXXX XXXX 0406

TERM: 05244081-003893

IA1 PBS NR:0003332179

ATC:01013 AED:000000

AID: A0000000031010

PSAM: 5374978-0000156600

ARC:00 STATUS:0000

AUT RODE: 154943

REF:003893 AUTORISERET

URA

65

014146

20-01-2010

B-01-2010

1

Ialt

BETALT

26 FEB 2010

SISIMIUT OLIE APS

3.000,90 Kr.

AKILIGASSAT SIULLIIT NASSIUNNEQARSIMASUT AKILERNEQARSIMANNGIPPATA

- ORSUSSAMIK PAJUNNEQASSANNGILASI!

SÅFREMT TIDLIGERE FREMSENDTE FAKTURAER IKKE ER BETALT,

-VIL DER IKKE BLIVE TILKØRT MERE OLIE!

Sisimiut Olie ApS

Kaassassuup aqq. 1
Postboks 9
Tlf: +299 86 40 20
Fax: +299 86 47 75
e-mail: sisolie@greenet.gl

Kontoret har åbent:
hverdage kl. 8:00 - 16:00
lørdag og søndag lukket

**FAKTURA
71514****AXEL LUND OLSEN****QAJAASAT 19 B-1158****3911 SISIMIUT**

Kundenr. 014146
Dato 30-09-2009
Forfaldsdato 08-10-2009
Side 1

Varenr.	Betegnelse		Antal	Pris	Ialt
	Følgeseddelsnr. 32354 GS				
2009	Solar - Arctic Grade	Ltr.	428,00	4,27	1.827,56
1200	Kørsel fast pris	Ltr.	1,00	110,00	110,00
	Automatisk opfyldning				

1.937,56 Kr.

AKILIGASSAT SIULLIIT NASSIUNNEQARSIMASUT AKILERNEQARSIMANNGIPPATA
- ORSUSSAMIK PAJUNNEQASSANNGILASTI!
SÅFREMT TIDLIGERE FREMSENDTE FAKTURAER IKKE ER BETALT,
-VIL DER IKKE BLIVE TILKØRT MERE OLIE!

Betalingsbetingelse : NETTO KONTANT 8 DAGE DEREFTER 2%

Kan indsættes /Akiliiffigineqarsinnaavoq; GrønlandsBANKEN A/S på Reg: 6471 Konto: 2009320

AXEL LUND OLSEN
QAJAASAT 19 B-1158
3911 SISIMIUT

1.937,56 Kr.

Betalings ID:

+71< 014146000715149+84092509<

